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NOTES ON SOME PROBABLE CAUSES OF THE CORROSION OF COPPER AND BRASS.*

By E. L. Rhead, F.I.C.

The corrosion of copper and its alloys has, more particularly during recent years, been forced upon the notice of metallurgists and engineers by the many instances of failure of these metals when subject to conditions under wich previously they had been found to be sufficiently resistant.

These metals are usually employed because their durability is greater than the cheaper but stronger metal—iron; and if this is doubtful, or if premature failure occurs, any advantage in using them disappears. Bearing in mind the nature of the uses to which they are put, the importance of the conditions influencing and rapidity of corrosion will be obvious.

Enunciation of a few of the more common cases in which corrosion occurs may be useful.

E. L. RHEAD.

(i.) The corrosion and pitting of the tubes of surface condensers, more particularly those using sea and estuarine waters for condensing purposes.
(ii.) The decay of Muntz metal sheathing, bolts, and the underwater fittings of ships.
(iii.) The deterioration of brazing alloy in copper pipes.
(iv.) The corrosion of steam-ship propellers.
(v.) The corrosion of the interior of locomotive boiler tubes.
(vi.) The rapid corrosion of copper sometimes noted on articles built up from sheet copper and subject to the action of fire gases.

In many cases when corrosion occurs the deterioration of the material does not at once reveal itself, and in others is only apparent when rupture takes place.

Whether the corrosion is or is not palpable depends largely on the appearance, and on the adherence or otherwise of the product of corrosion. If the product be soluble it will be removed from the surface as formed and a reduction in thickness will occur. The rapidity of this solution will depend on the solubility of the product and on the renewal by agitation of the solvent to prevent saturation taking place.

In some cases the first product of the action may be soluble, but the removal in solution may be prevented by secondary reactions resulting in the precipitation of some of the dissolved matter in another form. This probably occurs in the case of brass, which, during corrosion, loses zinc and becomes enriched in copper. Other chemical changes may lead to the production of insoluble adherent residues.

Obviously the most dangerous cases of corrosion are those in which the object retains its shape and size, and those that occur in situations where periodical examination is not possible. It is for purposes like these that copper alloys are commonly applied on account of greater durability.

Many of the instances of failure recorded show that the causes tending to promote corrosion are of a complicated character. The general conditions in two cases may be apparently alike, and trouble may arise in one case and not in the other; while the adoption of precautions indicated in one instance may not succeed in preventing a similar failure in what appears to be an identical case.

Particulars of corrosion of brass and Muntz metal are given in a paper by J. T. Milton and J. Larke.†

In condenser tubes the corrosion results in the formation of (1) longitudinal grooves, (2) pitting and perforation of the tube, and (3) the formation of plugs of spongy copper, in addition to the more or less uniform reduction in thickness that gradually takes place in tubes that behave satisfactorily.

The pits or holes are funnel-shaped, with the wide end of the pit on the water side of the tube. Occasionally such tubes show wastage from the steam side, but it is then more generally diffused. Pitting may extend over the whole surface, but it is more common on the side which is lowest when the tubes are in position.‡ The pits are more or less in lines, but frequently some are much more pronounced and are irregularly placed.

The plugs of spongy copper may extend through the thickness of the tube so as to allow them to be pushed out. They are roughly circular and could not have remained unalloyed in the manufacture of the tubes, as in that case they would have become elongated in the drawing of the tube. They could only result from the removal of zinc or by redeposition of copper.

The interior of the tube, when removed from the condenser, may be almost free from deposit, or there may be a considerable amount. In the event of serious corrosion the latter is often the case. This deposit consists of matter produced by the corrosion of the metal forming the body of the tube or by material mechanically carried in by the cooling water.

Sometimes much hydrated oxide of iron is present in the deposit, and frequently organic matter. Occasionally cinders form part of the solid matter present. The ac-

*Paper read at Manchester, England, Meeting of Institute of Metals, held October 13, 1909.

†Proceedings of the Institution of Civil Engineers, April, 1903, vol. cliv. p. 138.

‡Tomlinson, Proceedings of the Institution of Civil Engineers, vol. cliv. p. 172.

cumulation of this matter points to the water current being too slow to carry it away; it will consequently be more strongly heated.

Rapid failure of condenser tubes is generally accompanied by deep local pitting. Those that last for long periods show more or less uniform corrosion.

In Muntz metal and other similar alloys used as sheathing, tube plates, &c., the corrosion may extend inwards from the surface, though not equally from every part, till the whole mass is completely changed. The residue is brittle, breaks with a dull fracture, but yields a bright surface when filed. In other cases where rapid circulation effectually removes the products, general wastage accompanied by pitting may occur.

The corrosion of locomotive tubes generally results in the scaling of the tube, with more or less roughening of the interior. This in some cases takes place rapidly. The deposit contains oxide and chloride of copper in large amounts, in addition to smaller quantities of sulphate. In one instance the author found 43 per cent. copper, 18 per cent. zinc, and 1.87 per cent. sulphur present in the deposit removed from the tube.

The following analyses, quoted from Milton, show the composition of the sound and deteriorated portions of a tube plate and diaphragm plate of a condenser:—

	Copper. Per Cent.	Zinc. Per Cent.	Iron. Per Cent.	Tin. Per Cent.	Lead. Per Cent.
Tube plate, sound portion.....	59.07	39.07	1.01	0.22	0.63
Tube plate, corroded portion.....	82.17	17.26	0.22	0.31	0.04
Diaphragm plate, sound portion....	61.48	38.28	0.08	trace	0.16
Diaphragm plate, corroded portion.	69.87	29.85	0.12	trace	0.16

showing an increase of 8 and 23 per cent. of copper respectively.

The suggestions put forward in explanation of this peculiar behaviour are based on:—

(1) Selective chemical action.

(2) Corrosion resulting from chemical action set up, or promoted by, the electrical conditions resulting from the presence, side by side, in the alloy, of different components containing the constituents of the alloy in varying proportions, or from the presence of included impurities.

(3) The effect of vagrant electric currents escaping from the electrical equipment.

It does not seem possible for the first to take place unless affected by the second to a greater or less extent, but the electromotive force resulting from the contact of copper with zinc alloys containing it in large amounts is very feeble, amounting only to a fraction of a volt—in every case less than .08 when immersed in sea-water. This it would be difficult to assume as being sufficient to produce the rapid corrosion that sometimes occurs.

In the consideration of conditions affecting the behaviour of such brass work it is necessary to bear in mind the nature of the metal, the treatment it receives during manufacture, the materials with which it comes into contact during use, and other circumstances, such as temperature, which may affect it in any way.

The nature of the metal and the effects resulting from the separation of different components of varying composition, as also the protecting influence of metals, such as tin, added in small quantity, have received full attention at the hands of Professor Arnold, J. T. Milton and Larke, and others, and the conclusions arrived at, viz. that a dual structure is conducive to the rapidity of attack, appears to be established.

It does not, however, account for the irregular manner in which such corrosion often takes place. The care exercised, in the case of metals having a simple structure, in the manufacture of the alloys in the use of pure metals, and in other ways, must ensure uniformity of composition. With a view to contributing to a solution of the difficulty, the following experiments were carried out.

Samples of hard and soft copper and brass were submitted to corrosion. The rate of solution in salt water is slow and permits, during the lapse of time necessary to produce a sensible effect, considerable secondary changes. In consequence corroding solutions of a more active nature were used.

In one set of experiments solutions of ferric chloride of 1 and 2 per cent. strength were employed. The salt used was the ordinary commercial article, showing a slightly acid reaction.

The plates were of 26 gauge, with an exposed surface of 36 square inches. They were completely immersed in the solution. The amounts of metal dissolved were in the following proportions:—

No. of Experiment.	Solution Used.	No. of Hours.	Hard Copper.	Soft Copper.	Brass.
1	1 per cent. ferric chloride..	20	51	19	49
2	2 " " "	20	151	88	81
3	2 " " "	20	100	90	86
4	2 " " "	48	137	147	133

The plates on removal from the liquid presented a bluish black appearance. The film was evidently cuprous chloride, for on exposure it became green, and could be washed away. It was completely soluble in hydrochloric acid, and this was used to remove it. In removing the film from the hard copper, a series of parallel bands developed in the direction of the length. It might be that these bands represent regions of unequal hardness resulting from unequal pressures during cold rolling, which, being unequally acted on, were coated with different thicknesses of deposit.

The brass plates, one side of which was polished, showed copper enrichment round the cut edges, and on the polished side. This reddening was in some cases confined to the polished side, but in others marks, apparently scratches, or caused by mechanical means, also showed a deposit of copper. The enrichment on the polished face was in some cases generally diffused and in others patchy. The tendency for the formation of a copper deposit on the polished side and on scratched portions was very marked. The sheet were cut up by a guillotine, and in some cases in the adjustment of the plates the knife had made a mark parallel to the edge. A considerable amount of pressure had been exerted and a groove formed. Copper was found in the groove.

FIG. 1. BRASS PLATE SHOWING DEPOSITS OF COPPER IN GROOVES.

Plates were prepared in which parallel grooves were made by ruling with a tool which also scratched the surface of the brass. These were placed in ferric chloride solution, and treated as before. Similar copper deposits occurred in the grooves as seen in Fig. 1. It will be

observed that copper enrichment took place on those portions of the metal disturbed by cutting (the edges) and by the action of the tool.

Other experiments were made by bending together the two ends of a plate so as to bring the two surfaces as nearly into contact as possible. The smooth side was inwards. A flat plate of the same area was placed in the same liquid. The rates of corrosion were:—

Flat plate	185
Bent	88

The loss was approximately half. This is accounted for by the freely exposed surface being reduced by the bending. It was actually about .583. In one experiment a curious fact was noted. The inner surface was coated with a loose deposit of copper, very small in quantity, but distinctly visible. It was detached by slight rubbing, and was moved about by the flow of water. It was distinctly crystalline in character, and confined to the bright surfaces that had been placed together. In other experiments of a similar nature films of copper extending over a portion of the surface were visible. This copper may have been separated by a purely chemical effect due to the action of the zinc in the alloy reducing the copper dissolved from the surface, or it may arise from, or its deposition may be assisted by, the difference of the two surfaces, the smooth being slightly electro-negative to the rougher, and thus acting as the positive pole.

In both cases the degree of concentration of the solution and its renewal would have the same effect on the density and distribution of the copper deposit. Free circulation of the liquid would be retarded.

Below are given the results of a series of experiments on the corrosion of copper in various agents.

Plates of soft and hard copper, and of copper with one surface polished, were exposed in groups of three of the action of saline solutions made up as follows:

1. Hydrochloric acid (a 7.5 per cent. solution).
2. A solution of common salt (15 per cent. solution).
3. Common salt, through which a stream of carbonic acid gas was passed.
4. Common salt, with an addition of 1 per cent. of ammonium nitrite.
5. As in 4, but with a stream of carbonic acid gas passing through.
6. Common salt, with an addition of 1 per cent. of 20-volume hydrogen peroxide.
7. As in 6, with a stream of carbonic acid gas in addition.

All the experiments, except 3, were continued during ninety hours. Loss of weight occurred in the following ratios:—

	1.	2.	3.	4.	5.	6.	7.
Soft copper	37	5	18	1.5	55	8	37
Hard Copper	48	3	37	5	56	14	57
Polished copper	73	15	49	1.5	44	15	47

It will be seen that the hard copper shows greater susceptibility to attack although the experiments are not sufficiently conclusive.

The ammonium nitrite was introduced to illustrate in some measure the possible effects resulting from the use of sea-water contaminated by sewage, a condition sometimes arising in shore and estuarine installations, and in river and coasting vessels. Such water is also liable to be much more highly charged with carbonic acid gas than ocean water, the gas resulting from the decomposition of the organic matter present.

Hydrogen peroxide was used to illustrate the effect of a non-corrosive oxidizing agent similar in effect to dissolved oxygen.

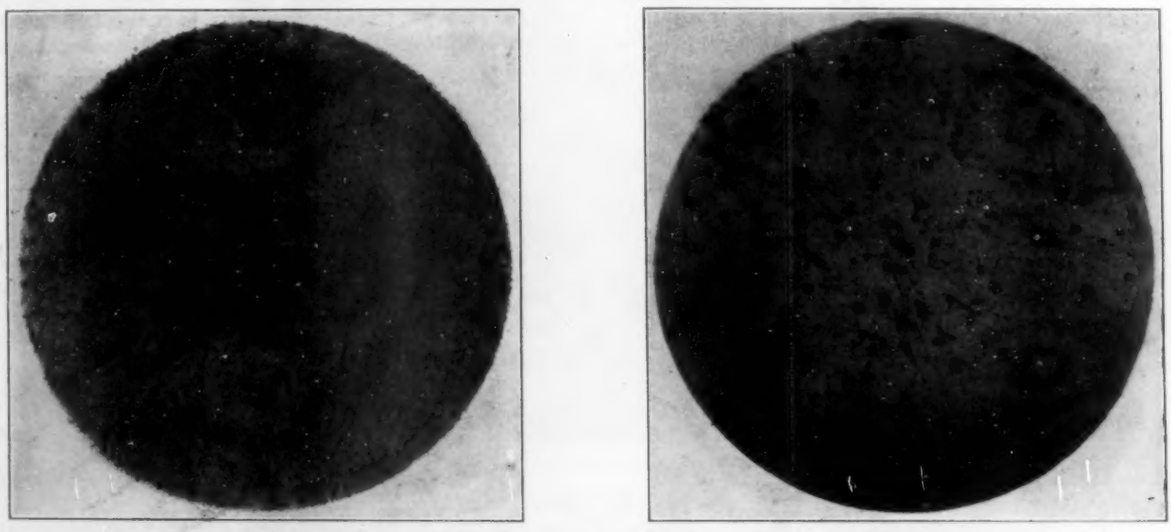


FIG. 2. HARD BRASS (UNANNEALED) MAGNIFIED 50 AND 120 DIAMETERS.

The increased action in the presence of carbonic acid gas is in all cases marked.

Hard and Soft Brass.—Two similar plates of hard brass were taken, and one annealed before use. These were subjected to corrosion in a 1 per cent. solution of ferric chloride. The relative amounts of corrosion were: soft, 51; hard, 49.

Apparently this is not in sequence with the former results, but the sample of hard brass became quite reddish on both sides due to copper enrichment. The copper did not form a film, but when placed under water the color showed very distinctly.

The softened plate showed no trace of such an appearance, and was uniformly acted on except where the edge of the sheet projected above the level of the corroding liquid and came into contact with the air. Just below this level the surface showed greater corrosion and some copper enrichment. Along two narrow lines, the continuations of which were visible owing to their somewhat greater brightness on the part not immersed, this deposit could be traced for about half an inch below the line of liquid. These had the appearance of marks produced by rolling, the effects of which had not been quite obliterated by the

annealing. Both plates were treated in the same jar, but were insulated from each other by glass rods.

The structure of the metal before and after annealing is shown in Figs. 2 and 3. The effect of the cold rolling on the crystalline structure will be noted.

Further experiments were made as follows: A strip of the same hard brass measuring 0.02 inch thick was softened over a portion of its length, and bent in the form of a ∩. The two limbs were placed in a corroding liquid containing approximately 10 per cent. hydrochloric acid and 5 per cent. copper chloride. They were left for twelve and twenty-four hours respectively. On removal from the liquid the difference in the rate of attack was very obvious. The hard limb had been seriously corroded, especially on the side facing the soft limb. The irregularity of the attack was very marked. It was most vigorous in lines running across the strip. These were parallel to each other, and in the direction of rolling. Along these lines deep grooves had been cut, and the surface was porous and roughened. Near the surface of the liquid, as might be expected, the action was much more extensive than lower down, but it extended to the bottom of the strip. When the experiment was prolonged to twenty-four hours the differences were still more pronounced. The hard limb was so corroded that the part near the surface of the liquid was reduced to a mere film 0.003 inch thick, and could only be removed from the liquid, without breaking away, with care. One of the strips actually broke away. Lower down the corrosion was somewhat less, and at the bottom the thickness was much greater, but showed strong corrosion. The softened limb was little affected; a few very shallow grooves across its surface, and slight roughness near the top of the liquid, being the only effects of the treatment. After annealing and cleaning, it originally measured 0.019 of an inch thick, and at the top, in the most affected part, 0.0185, while lower down its thickness was the same as at first. The skin had not been removed except in the lines. It may be, I think, assumed that these represented the irregularities not completely removed by the annealing. They extend quite across the strip. It appears from these results that the hard material is electro-positive to the softer, and solution therefore, more readily takes place. Whether this is due to the fracture of the crystals during cold rolling, by which the texture is made more permeable to the corroding fluid, or whether the state of strain in which the metal exists in the hard material is the cause of the more rapid attack, does not appear.

Considered in the light of these results, the explanation of some of the phenomena occurring in some of the more rapid cases of corrosion may be facilitated, particularly the pitting and corrosion more or less in lines. The roughness caused by the corrosion thus set up may form the points from which the liberation of the gases contained in the condensing water takes place. These vary in amount in sea-water from 2.5 to 3.5 volumes of gas in 100 of water.*

	CO_2. Per Cent.	O. Per Cent.	N. Per Cent.
2.5 volumes contained.....	28.61	49.44	21.94
3.5 volumes contained.....	48.28	17.22	34.44

Dittman (Challenger Report, 1884) states that the CO_2 in sea-water is less than sufficient to produce bicarbonate with the carbonates present.

Any tendency to concentrate the evolution of gas must also tend to localize the corrosion.

A similar condition applies also to solid matter lodging in the condenser tubes. There is, however, this difference: the rough metal surface is part of the wall by which the heat is conducted from the steam to the water. The persistence with which bubbles of gas liberated from solution continue to rise from the same point, sometimes without any apparent cause, is well known, as also is the effect of introducing solid matter in some cases to prevent bumping.

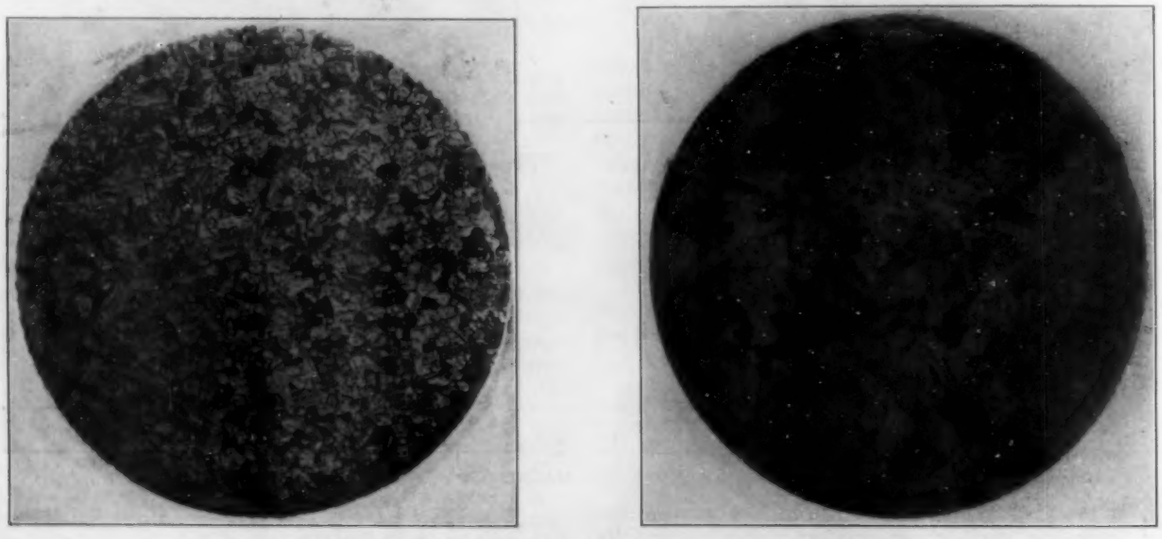


FIG. 3. HARD BRASS (ANNEALED) MAGNIFIED 50 AND 120 DIAMETERS.

In the discussion re J. T. Milton's papers already referred to, various points then raised seemed to suggest that the causes of corrosion were not necessarily connected with the purity of the metal.

The figures given by Mr. Darley in connection with Muntz metal sheathing used in protecting harbor piles were very striking, materials in use for twenty-five and twenty-six years respectively showing little appreciation of the copper contents. He asserted that the trouble did not arise prior to 1899, and gave instances of very rapid deterioration subsequently. Without necessarily accepting the latter date, it may be that the increase in power of the rolling-mills, and other appliances used in the working of copper and brass during recent years, and other changes in the process of manufacture may in some

*Hunter, "Journal of the Chemical Society," 1870, p. 20.

measure account for the changes in texture of the material, and it would appear that it should be the aim of the manufacturer to secure the greatest uniformity. The practice in tube making of giving the tube a final cold drawing in order to stiffen the tube, but not so as to render annealing necessary, may develop hardness sufficient to account for the initial roughening of the surface from which the corrosion is subsequently continued in increasing amounts promoted by the liberation of gas. This renders irregular action possible without reference to slight changes in the composition of the metal.

It does not appear possible to deal satisfactorily with the cooling water. The higher the temperature of the steam passing to the condenser and the slower the rate of flow, the higher will be the final temperature of the cooling water. This must effect the liberation of gases from the water and the effect upon the tubes.

The corrosion of propeller blades is probably not unconnected with the liberation of gas from the water by the differences in pressure resulting from the revolution.

The discussion of this paper will be published in the December number.

THE COATING OF IRON AND STEEL WITH NON-FERROUS METALS.

RECENT IMPROVEMENTS IN THIS IMPORTANT FIELD.

The substitution of iron or steel coated with copper, brass, nickel and other similar metals, for sheet or wire of the virgin metals themselves, has long been the aim of many scientists. The advantages of such substitution are obvious, the main one being the large difference in cost of production and consequent economy in its use. Another important consideration being increased strength and wearing qualities. In this connection it is interesting to note a new process, which has just come to light, for the coating of iron or steel with copper, brass, etc., by simple immersion. By this is meant, that by the dipping or drawing through a bath of molten copper or brass, of a strip or wire of steel a good durable coat is made to adhere so as to withstand any subsequent working that is desired. Before we describe this new process, it may be well to retrospect a little and review the various methods now in use for the coating of iron or steel with non-ferrous metals.

WALTER S. ROCKEY.

TIN AND ZINC COATING STEEL.

The preservation of iron and steel from rust by means of a coat of tin or zinc has been successfully done for many years. There are at present three separate and distinct processes or methods employed to produce this result. The simple immersion process, where the steel is dipped or drawn through a molten bath of the metal it is desired to coat with. The process where a bath or solution of the metal is made and the coating put on by means of the electric current, and the "Sherardizing" process, (in the case of zinc only so far), when the steel is exposed to zinc dust. The dust on cooling forms a metallic coating claimed to be equally as durable and effective as that produced by the dipping or plating processes.

In the case of tin and zinc the immersion process requires but a low temperature and no trouble is experienced from oxidation or burning, provided the steel is chemically cleaned before coating. But when copper, brass and other high melting point metals were tried, the problem assumed proportions that seemed almost impossible to solve. It was found when attempts were made to coat steel with copper or brass for instance, by the immersion process that, owing to the high temperature necessary for melting the copper or brass, when the steel was drawn from the bath, the coating metal rapidly oxidized and burned off entirely or in spots. This was particularly true in the case of brass, owing to the ready oxidation of zinc, when heated in contact with air, to the temperature required for melting of brass. As soon as the steel with its adhering coat of brass was withdrawn from the bath, rapid oxidation took place and caused a decomposition of the coat. The zinc being oxidized or burned out and leaving a scaly coat of a mixture of oxidized copper and zinc with a little brass.

After a number of years of study and experimenting, Walter S. Rockey a chemist and metallurgist of New York City finally came to the conclusion that the problem was not altogether a chemical one but tended more to the physical and mechanical side. In furthering this idea he associated himself with a mechanical expert, F. H. Eldridge, a man of large and varied experience.

These two men have now finally succeeded in coating steel with copper, brass, nickel, tin, silver and other metals in an entirely satisfactory manner.

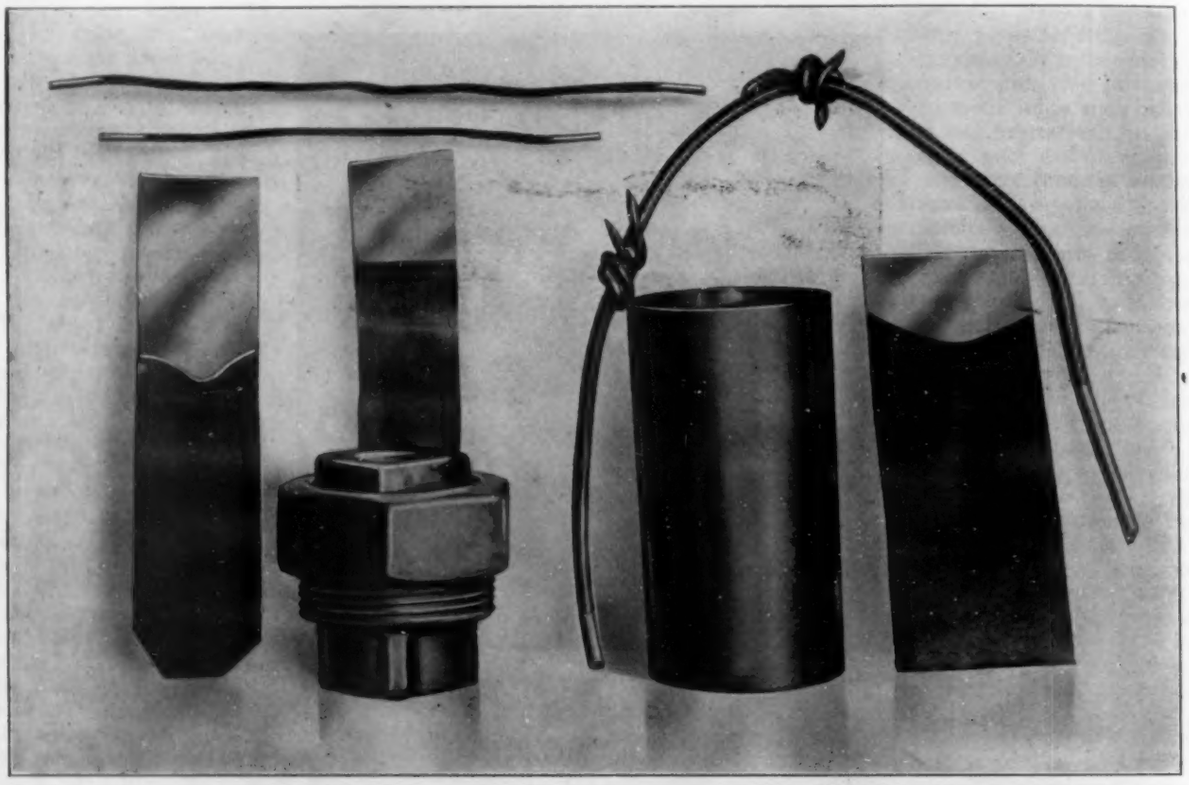
APPLICATION OF THE PROCESS.

We show in the illustration some of the results obtained by their process, which is fully covered by patent rights (claims allowed). The various classes of articles shown are indicative of the wide field of application open to this process.

It is claimed that the copper and brass coated steel or iron will find a place in the manufacture of roofing materials and all kinds of stamped and spun ware such as is now made of solid copper and brass. These articles include—bath and wash tubs, wash and range boilers, pails, chafing dishes, percolators, tea pots, etc. The copper coated wire will have a wide application for telegraph and telephone wire, and all circuits requiring only a low potential currrent. The brass coated wire is

used for barbed wire fencing and here a notable economy is noticed. Aside from the non-rusting qualities of the coated wire, is the fact that by this process the barbs are welded to the wire itself by the simple passing through the molten brass. This alone will effect a great saving as only one strand of wire is necessary where often two are now used.

In the manufacture of plumbers fittings and house hardware supplies there is another important application as all of these cast iron articles can be brass or copper plated and sold for good profit at prices far below the solid brass and copper articles. In the manufacture of tubing, the coated article can be substituted with equal facility for the solid in nearly all cases where such tubing is required.



Copper Coated Steel Wire
Copper Coated Steel Sheet Plumbers' Fitting Brass Coated
Brass Coated Steel Wire
Brass Coated Steel Tube Brass Coated Steel Sheet

BRASS AND COPPER COATED STEEL PRODUCED BY THE ROCKEY-ELDRIDGE PROCESS.

THE PROCESS.

The whole secret of success of the newly discovered process lies in the method of handling the metals used, and in the flux employed. If a thin coat of copper or brass is required, the coating metal is so treated as to the temperature and amount of flux used, as to adhere in a filmy layer. If a thick heavy coat is desired, the temperature is lowered and the proportion of the flux and its quantity are changed to suit the case. The flux itself is of such a nature as to be either thinly fluid or thick and vicious. The composition of the flux for the present is not published but it can be said that it is cheap in price and easy to compound it in large quantities.

The coating metal is melted in a specially prepared crucible, when fusion is complete, the flux is added, and then the steel is introduced. The surface of the steel as said above, having been previously prepared so as to be chemically clean. This is accomplished by pickling and scouring. As the strip or sheet of steel is drawn out of the coating bath, the flux floating on the top of the bath, adheres to the surface of the coating metal, and this protects its surface from the oxidizing effects of the atmosphere. After the coated article has cooled the flux may be readily knocked off, leaving the surface of the metal as bright and clean as though it had been buffed and polished. One good economical feature of the flux is, that it is not lost, but can be used over and over, only replacing from time to time, what is lost through the mechanical handling.

The inventor of this process whose portrait heads this article, Walter S. Rockey, is a chemist and metallurgist of 23 years' practical experience. He was educated at the Worcester University of Worcester, Ohio and Columbia University of New York. Mr. Rockey has long been interested in just such problems as this and has lately evolved a process for the production of metallic calcium, sodium and potassium. Among Mr. Rockey's associates in these scientific investigations are men who stand high in the metallurgical and mechanical professions and it is their intention to exploit this process and to that end they are now making, at their laboratory, 462 Tenth avenue, New York, extensive plans and preparations for the brass and copper plating of the various types of iron and steel goods that are at present manufactured, viz,: sheet, wire, tubing, plumbers' fittings, hardware supplies, chains, wire fencing, bath tubs, pails, wash tubs, etc.

Mr. Rockey states: "The copper and brass plated iron and steel that is produced by this perfected immersion process has exactly the appearance of solid copper and brass and cannot be distinguished from these metals and for most commercial purposes can and

will be successfully substituted for these metals and is for many purposes superior to them on account of greater strength."

It has been possible for some time to coat steel with copper and brass, etc. by electroplating and this is now being done on a large scale by two or three concerns in the United States and by one at least in Germany. A description of this process for copper coating steel as practiced in England was published in the October issue of THE METAL INDUSTRY. Another process which was described in the same number, consists of drawing a copper shell onto a steel billet and this is also being done successfully on a commercial scale. This latter process, however, does not produce an intimate weld between the two metals and therefore will not admit of after working.

A method for the production of copper coated steel sheet and wire that has been very successful was invented by John F. Monnot of New York after years of investigation. This process consists in dipping a billet of steel, first in a bath of copper heated far beyond its melting point, or until it is in a "super molten condition," and then into another bath which is not heated

LABORATORY WHERE THE ROCKEY-ELDRIDGE PROCESS WAS EVOLVED.

quite so high. The first immersion produces a "film" coat of copper welded to the steel. The second gives any desired thickness of copper to the first or film coat.

The billet of steel with its coat of copper is then reheated and rolled down into sheet or drawn into wire. The copper envelope being reduced in thickness proportionately to the reduction of area. The operation taken as a whole is somewhat tedious and expensive. The whole process has to be conducted with extreme care and every step has to be performed exactly within certain prescribed lines. The billet of steel, for instance, has to be the most carefully prepared, first by sand-blasting and pickling. After the initial preparation of its surface, the billet is enclosed in a steel shell into which is conducted carbon monoxide gas for a reducing atmosphere.

The billet in its shell is then suspended over the crucible containing the copper, and on being released slips out and down into the "super-molten" metal where the film coat is obtained. It is then withdrawn and after cooling somewhat, the billet and shell are plunged into the second copper bath. This time the melted copper enters through small holes in the sides of the shell and thus the coat of required thickness is obtained. The space between the outer diameter of the billet and the inner diameter of the shell determining the thickness of the coat. This process has been the subject of numerous patents, many of which have been described in recent numbers of THE METAL INDUSTRY.

PLATERS' WRINKLES.

By CHAS. H. PROCTOR.

(Continued from July.)

In preparing black nickel baths from nickel salts, sal ammoniac and sulpho cyanide of potassium. A deeper and richer black can be produced by adding, ½ oz. carbonate of copper dissolved in 1 oz. 26 per cent. ammonia water to each gallon of solution and using anodes of sheet brass instead of the usually prescribed nickel anodes.

The color is obtained more rapidly and will color very satisfactorily with a soft buff.

When coloring up plain oxidized copper surfaces, after relieving, to produce the mottled effect, use Vienna lime on the buff. This gives a clearer color to the copper and the oxidize. Rouge compositions oxidize the relieved copper and give a reddish tinge to the black, necessitating the rewashing of the articles before lacquering. Vienna lime prevents this and the articles can be lacquered from the wheel.

When your acid copper baths commence to give trouble, add common alum to them in the proportion of 1 or 2 oz. to the gallon, before making any further additions. If this does not overcome the trouble your bath needs metal, it is then advisable to reduce the bath somewhat with water. Then add as much sulphate of copper as your bath will absorb over night. This can be readily accomplished by suspending the copper salt in the usual acid dipping baskets made from earthen ware or aluminum upon your negative or work poles, or common burlap bags can be used for the purpose.

When nickel solutions are in good working condition it is easy to maintain them in that condition, even when worked constantly during the day. The amount of nickel deposited is not entirely replaced by the anodes even when as much anode surface is exposed to the action of the bath as can be conveniently placed upon the supporting rods.

To keep your baths up to their full working capacity, every other evening add ½ oz. of single sulphate of nickel to each gallon of solution and once a week, preferably on Saturday, add ½ oz. of sal ammoniac to each gallon; this may be added in the same manner as mentioned for replenishing acid copper baths.

Rolled sheet nickel anodes of about 16 Brown and Sharpe gauge in thickness are used extensively in connection with gold and silver anodes in the baths of these metals. Platers that use them claim to obtain brighter and harder deposits than when gold or silver anodes are used exclusively.

To produce the matt surface upon articles made up from aluminum, first wash in benzine or gasoline, then immerse momentarily in a warm potash solution, then rewash and immerse in clear aqua fortis. This removes the oxide formed in the potash and leaves the metal clear and white.

(To be continued.)

THE SURFACE APPEARANCE OF SOLDERS.*

By C. O. Bannister, A.R.S.M., and H. J. Tabor.

On searching through metallurgical and chemical literature, it is surprising to find that very little information has been published on questions relating to the manufacture, properties, methods of analysis, and uses of solders, and the following work has been carried out with a view of testing the varying conditions which affect the surface appearance of solders, and particularly the effect of small quantities of antimony and other metals on tinman's solder.†

C. O. BANNISTER.

H. J. TABOR.

It is well known that sales of solder are often influenced by appearance rather than by chemical analysis, and the following are the chief properties taken into account:

1. Its appearance. It is generally cast in the form of strips, and particular attention is paid to the nature of the surface as to whether it is white or has a yellowish color, bright or dull, smooth or rough, spotted, pitted or pimply, and whether it has or has not a furrow.
2. Its toughness, and the nature of the fracture.
3. Its hardness.
4. Its melting point.

A good solder, as far as appearance is concerned, should, when in the form of strips, be white, have a furrow running along the centre be smooth and free from rough patches, spots, pits, or pimples, and be free from stippling at the ends.

The following are the conditions which affect the appearance of solders:—

1. Chemical composition.
2. The temperature of the metal when casting.

The surface is generally better when the metal is poured hot, but not too hot. Metal which pours spotty may often be remedied by varying the conditions of pouring, etc.

3. The material of which the mold is made, a bad conductor of heat like marble being generally supposed to give a better surface than one made of a good conductor such as iron.
4. The temperature of the mold; to a certain extent, the slower the metal sets, the better the surface.
5. The thickness of the strips.
6. The use of a cone in pouring or the addition of a little grease or resin.

I. EFFECT OF ANTIMONY.

The first series of experiments were made in order to examine the effect of small quantities of antimony on tinman's solder, and at the same time to determine the effect of casting under different conditions.

Preparation of the Alloys.—Preliminary experiments were first carried out with a small iron mold, giving a strip of metal 3 inches long, 5/16 inch wide, and ¼ inch thick, and a small marble mold giving a strip 4 inches long, ½ inch wide, and ⅜ inch thick. The alloys for these strips were prepared in small crucibles over a bunsen burner. The required amount of antimony was added to the molten lead-tin alloy either as metallic antimony or, in a few cases, as a rich lead-antimony alloy containing 25 per cent. antimony.

The metal in each case was covered with resin or charcoal, and analyses were carried out to control the composition of the resulting alloys. These experiments were repeated on a larger scale with full-sized molds in the case of the alloys giving the best surface appearance, the alloys being prepared in a crucible in a wind furnace under charcoal.

The dimensions of these larger strips were:—

(a) In the iron mold: length, 11 inches; width, ½ inch; thickness, ½ inch.

(b) In the marble mold: length, 16 inches; width, ½ inch; thickness, ⅜ inch.

The following are the details of the experiments carried out on the antimonial solders:—

Experiment I.—The molten alloys were poured at a red heat into a hot iron mold and allowed to cool slowly.

Experiment II.—The alloys were cast at a lower temperature, just sufficient to char a piece of wood, into a hot iron mold.

Experiment III.—The alloys were cast at a slightly higher temperature than that used in Experiment II., but a cool iron mold was used, so that the metal solidified in from twenty to thirty seconds after filling the mold.

Experiment IV.—The alloys were cast at a temperature just sufficient to char a piece of wood, on to a cold iron plate, where they solidified immediately.

Experiment V.—The alloys were cast at a fairly low temperature into a cool marble mold, in which they solidified very soon after filling it.

These experiments were carried out with a series of alloys containing 46 per cent. tin, from 1 to 10 per cent. antimony, the rest consisting of lead; and for comparison an ordinary tinman's solder, 50 per cent. tin and 50 per cent. lead, was also used. The results obtained for the alloys containing up to 5 per cent. antimony are summarized in the following table; as the whole of the alloys containing more than this amount of antimony were more or less frosty, rough, spotty, pimply, or crystalline under the conditions used in each of the experiments, these have not been entered. The ingots obtained were nicked, fractured, and the fracture examined. The alloy containing no antimony was tough and gave a silky fracture; the alloys containing antimony were not so tough, and were very finely crystalline, this crystallization slightly increasing with an increase in the amount of antimony. The alloys containing 1 and 2 per cent. antimony were fairly tough; the alloy with 3 per cent. was inclined to be brittle, and this property gradually increased, until with 7 per cent. antimony it was quite brittle.

On comparing the results given in the table, it will be seen that with 1 per cent. of antimony the surface is not so good as that obtained with ordinary tinman's solder, whereas with 2 per cent. of antimony a surface equal to or better than tinman's solder can be obtained.* On increasing the antimony above 2 per cent., roughness, spots, pimples, or frostiness is obtained.

*Paper read at Manchester, England meeting of Institute of Metals, October 15, 1909. Parry, "Notes on Assaying."

†This has already been noted by Parry.

The experiments carried out by casting in full-sized molds confirmed the results obtained in the smaller molds; the alloy containing no antimony was not quite equal in appearance to that containing 2 per cent.; the furrow in the alloy containing 1 per cent. antimony was not very well developed, and with 3 per cent. of antimony pimples and spots made their appearance. In some cases the furrow was more pronounced when a marble mold was employed than when an iron mold was used.

The microscopic examination of these alloys throws some light on the effect of antimony when added to solder, for in the case of the alloy containing 3 per cent. of antimony bright cubical crystals are seen on the prepared sections after polishing and etching with hydrochloric acid. These crystals probably consist of the compound SnSb, and as this compound has a lower specific gravity than the bulk of the alloy it rises to the surface. Even in the case of the small strips cast in the marble mold, which solidified very soon after pouring, very distinct segregation of the crystals at the surface was noticed, and there is little doubt that this segregation causes the appearance of spots, etc., on the surface. On the other hand, the alloys containing 1 and 2 per cent. of antimony respectively contained no separated crystals of this compound.

TABLE SHOWING THE EFFECT OF ANTIMONY ON THE APPEARANCE OF SOLDER.

Experiment.	Tin ..... 50 Antimony ..... 0 Lead 50	Tin ..... 46 Antimony ..... 1 Lead 53	Tin ..... 46 Antimony ..... 2 Lead 52	Tin ..... 46 Antimony ..... 3 Lead 51	Tin ..... 46 Antimony ..... 4 Lead 50	Tin ..... 46 Antimony ..... 5 Lead 49
I. Metal poured at a red heat into hot iron mold and cooled slowly.	Bright crystaline, with rough patches.	Not so bright; crystaline, with large number of rough patches.	Bright, with a certain amount of roughness.	Bright, yellowish color; irregularly dispersed spots.	Dull, yellowish color; smooth, but frosty.	Bright, with deep irregular cavities.
II. Metal poured at a moderate temperature into hot iron mold.	Bright and smooth, with furrow.	Bright, smooth, with slight inclination to frostiness.	Smooth and brighter than the alloy containing no Sb.	Smooth, frosty; small clear spots.	Smooth, white, but frosty.	Bright, smooth, with slight development of spots and frostiness.
III. Metal poured at a slightly higher temperature than in previous case into cool iron mold.	Bright, smooth, with furrow.	Bright and smooth.	Very bright and smooth, with furrow.	Bright and smooth, except for pimpliness along the furrow.	White, smooth, flat, and frosty.	Bright and smooth, except for slight pimpliness along the furrow.
IV. Metal poured at a moderate temperature on to a cold iron plate.	Fairly bright and smooth.	Fairly bright and smooth, with small amount of roughness.	Bright and smooth.	Not very bright; pimply.	Smooth, frosty surface.	Fairly bright, with small pimples.
V. Metal poured at a moderate temperature into a cold marble mold.	Bright and smooth, with furrow.	Bright and smooth, except for slight frostiness at ends.	Bright and smooth, with furrow.	Frosty, with spots.	Smooth, frosty, with spots.	Bright, with pimples; inclination to frostiness.

II. EFFECT OF COPPER.

In these experiments tinman's solder was made up as before, but with the addition of small quantities of copper, which were added to the molten tin before making up the alloy with lead. The alloys were poured into the small marble mold, the appearance of the surface noted, and then the alloy was fractured, and the strength and nature of the fracture also noted.

It will be noticed from the following that the chief effect of copper in small quantities is to cause blisters and crystallization down the center; in quantities less than 0.6 per cent. the surface appearance is not bad, especially if precautions are taken to use the temperature for pouring, most suitable to the composition in question; it was found possible to get very different results by slightly varying the temperature of casting. Above 0.6 or 0.7 per cent. the surface appearance was quite inferior, as it became dull, flat, and crystalline in addition to having many blisters. It may be mentioned that copper has a much greater effect on the surface appearance of tin than on solder. On fracturing the specimens it was noted that copper hardened the solders, decreased the toughness, and and changed the silky fracture into a minutely crystalline one.

Copper Per cent.	Appearance of Surface.
0.1	Fairly bright, with furrow; inclination to form blisters.
0.2	Fairly bright; slight crystallization in the furrow; more blisters.
0.3	Surface slightly dull; crystallization down center; small blisters.
0.4	Fairly bright surface, with good furrow; blisters.
0.5	Fairly bright; crystalline in furrow; large blisters.
0.6	" " "
0.7	Rather dull; crystalline very little furrow; flat surface; blisters.
0.8	Dull and crystalline; very slight furrow; blisters.
0.9	Dull and crystalline all over; flat, with blisters.
1.0	" " "

III. EFFECT OF SILVER.

The effect of small quantities of silver on the surface appearance was ascertained, because certain Colonial users of large quantities of solder prefer these to be made with lead containing silver. In these experiments the silver was alloyed with the lead and then the necessary tin was added, and the solder poured into a marble mold as before.

Silver Per Cent.	Surface Appearance.
0.1	Smooth, even, with good furrow, but with peculiar milky white, opalescent effect.
0.2	Smooth, even, with good furrow, but with peculiar milky white, opalescent effect.
0.3	Good surface and furrow, the milky effect becoming more definitely crystalline.
0.4	Surface becomes distinctly white and crystalline, especially in center.
0.5	Surface becomes distinctly white and crystalline, especially in center.
0.6	Surface becomes distinctly white and crystalline, especially in center.

Up to 0.2 per cent. of silver a peculiar but by no means unpleasant appearance is given to the solder, which, on increasing the silver, develops into a very white and distinctly crystalline surface, especially about the center of the ingot. These solders were quite tough.

IV. EFFECT OF ZINC.

Extremely minute quantities of zinc were found to be absolutely fatal to the appearance of solders, as will be seen from the following notes:

Zinc Per cent.	Surface Appearance.
0.01	Minutely crystalline all over.
0.02	" "
0.1	Very crystalline, with pimples, blisters, and uneven surface.
0.2	Extremely uneven surface.

Besides the very inferior surface appearance obtained on making solders with zinciferous metals, difficulty was met with in pouring clean from the crucible, a tendency to the formation of skins and skulls being noted.

V. EFFECT OF BISMUTH.

In quantities up to 1 per cent. bismuth was found to have no appreciable effect on the surface appearance of tinman's solder.

CONCLUSIONS.

1. Tinman's solder containing 2 per cent. of antimony gives, under proper conditions of casting, a surface which is bright, clear, smooth, and superior in appearance to that of the alloy consisting wholly of lead and tin in equal proportions.

2. Solders containing more than 2 per cent. of antimony give surfaces which are either rough, spotty, frosty, or pimply, but the extent to which these defects are present does not increase in proportion to the amount of antimony added.

3. The surface obtained by casting in marble molds does not seem superior as regards brightness, smoothness, or clearness to that obtained in iron molds, but a more clearly defined furrow is generally obtained.

4. Solders containing small quantities of copper give good surfaces, but with a tendency to blister, while large quantities give dull, flat, crystalline surfaces.

5. Solders containing small quantities of silver have a peculiar white crystalline appearance on the surface.

6. Zinc is a most detrimental metal to have present in solders, as minute traces give very inferior surface appearances.

7. Bismuth in small quantities has no effect on the surface appearance of solders.

THE DEVELOPMENT OF MELTING FURNACES.

A Description of the Earliest and Latest Types.

By L. J. Krom.

(Continued from October.)

The last installment of this article closed with the description of the Woodison oil furnace manufactured by The Detroit Foundry Supply Company of Detroit, Mich. There are several other furnaces of this type, which are being extensively used. One of them is

THE SPRINGFIELD OIL HEATED FURNACE.

The cut in Fig. 20 shows the oil-fired furnace manufactured by Gilbert and Barker Manufacturing Company, Springfield, Mass. This furnace is equipped with the Springfield Process (patented) for burning crude oil, and by virtue of this process, the company claim the highest results for the furnace. The furnace is entirely portable and has a self-contained device for raising the cover. No stack or chimney is required under ordinary conditions, as the fuel is perfectly consumed and no unconsumed gases are discharged into the atmosphere. Where metals are melted that will evolve poisonous fumes or vapors, as arsenic compounds, a hood is necessary.

GAS, OIL, COAL OR COKE TILTING CRUCIBLE FURNACES.

We come now to the class of melting furnaces which still use a crucible, are used with practically any sort of fuel, and are stationary or built so as to be tilted and poured where they stand or can be moved to any desired point.

ROCKWELL FURNACE COMPANY'S CRUCIBLE TILTING FURNACE.

In cut 21, we illustrate the crucible tilting furnace manufactured by the Rockwell Furnace Co., 26 Cortlandt street, New York. This furnace has many advantages and will be readily appreciated by the foundrymen. As can be seen by the illustrations, the crucible is not removed while pouring the metal from the furnace, but remains fixed and the metal is transferred to the molds by means of a heated ladle or crucible.

The burner, which is operated with a fan blast of but 12 ounces, makes but little noise and uses either oil or gas fuel. It is so constructed that the flame projects down against the bottom of the chamber and not against the crucible (as per cut No. 22), insuring long life to same. In case of the crucible breaking the metal is all retained in the furnace, and will not run on the floor and the heat may be continued as though the crucible had not been broken, and the metal poured the same as in the open-flame furnace.

Any air pressure from 12 ounces may be used; the furnace can be operated from any available air and oil

system, which may be supplying other furnaces, a separate plant being unnecessary. The cover is manipulated by a lever conveniently located at the rear of the furnace, from which a pin engages a ratchet and holds the door rigidly in any required position and permits covering the crucible after pouring, without returning it to an upright position.

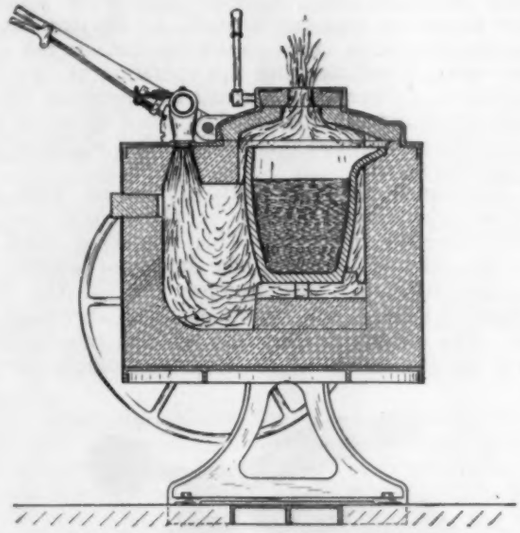


FIG. 21. ROCKWELL FURNACE COMPANY TILTING FURNACE.

Scrap metal may be fed through the top of the larger cover, by raising the small vent door; this may be done while the blast is on. If too large to drop through the waste heat passing around it, melts it down and it will drop into the crucible. As the crucible is not removed, after the first heat, metal is always put in a hot pot, which greatly facilitates the melting. The peculiar construction of the heating chamber and the application of the flame reduces the oxidation to a minimum.

FIG. 22. IN POURING POSITION.

The number of heats per day will vary from 6 to 10 and the amount of fuel required will range from 1½ to 2 gals. of oil or 210 to 420 cu. ft. of natural gas per 100 number of metal melted. The furnace is easily relined with simple and inexpensive fire tile. These furnaces are at present made in four sizes. No. 10, 11, 12, and 13 using 4, 6, 9, and 12 gallons of oil per hour and to hold No. 60, 125, 275, 400 crucibles respectively. They are installed in quite a number of the large plants of the United States, melting all grades and classes of metal. Scrap yellow brass wire from the ends of safety pins, etc., have been melted hot enough for pouring, very light thin castings at a loss of but 3 per cent.

The average loss for six months on melting journal brasses at the Metals Corporation, at Hillburn, N. Y., was 1½ per cent. which is very low, considering the fact that some of their metal requires remelting to insure thorough alloying. They are getting on an average of 8 heats per day of 350 pounds per heat making a total of 8,400 pounds per day from three furnaces of this type. Their crucibles average 27 heats each, and the linings are in good shape after six months' wear, and with a little care will last one year.

NATURAL DRAFT OIL BURNING FURNACE.

A tilting crucible furnace burning oil as fuel and operating under natural draft is manufactured by The Potters Kiln and Tool Works, 3151 Cottage Grove avenue, Chicago, Ill.

It is made in various sizes of the tilting type shown in cut 23, and also in the pit furnace type with draft outlet on the side as in the ordinary coke or coal burning furnace.

FIG. 23. KUEHL FURNACE.

Briefly the principle of burner, which will burn any hydro-carbon but preferably kerosene is: a feed pipe enters a perforated tube fitted on the bottom with a pan held with hinge and catch, the oil passing through above mentioned feed pipe is partly converted into a gas by the heat deflected from the pan which also serves to catch and gasify any surplus oil dripping from feed pipe. A number of burners can be attached to the larger sized furnaces or in fact applied to annealing or core ovens, steam generators and similar apparatus.

Among the advantages claimed are, first of all the low initial cost of the apparatus and installation, which as the name of this furnace suggests, requires no blower, steam or air pressure of any kind. The extreme simplicity is another feature, for the whole arrangement is built so that any furnaceman or molder can operate it. There are no parts to wear out, for the linings, burner and other parts on a number 60 tilting furnace, which has been in

constant use for months, show no wear, the manufacturers contend that the wear on linings in most other furnaces is caused by the blast, which they compare with a stream of water under pressure turned on a brick wall.

No special design of crucible is required, which in itself is a distinct advantage, as any of the standard makes can be used, a point most foundrymen who have used oil furnaces can appreciate, and it is claimed the average life of a crucible in this furnace exceeds 60 heats. The consumption of oil is very small; on a number 60 furnace the cost is well within 15 cents per hour, while a number 125 can easily be operated on less than 20 cents per hour, which, taking into consideration the fact that no power is required, is remarkably low.

There has always been some objection to the odor and gases of most oil furnaces, which along with the smoke are entirely consumed in this furnace, leaving not even the slightest odor of the fuel oil.

THE "REYELBEC" CRUCIBLE FURNACE.

The furnace shown in cut 24 is the invention of Charles E. Bleyer, president of the Hawley Down Draft Furnace Company, Chicago, Illinois.

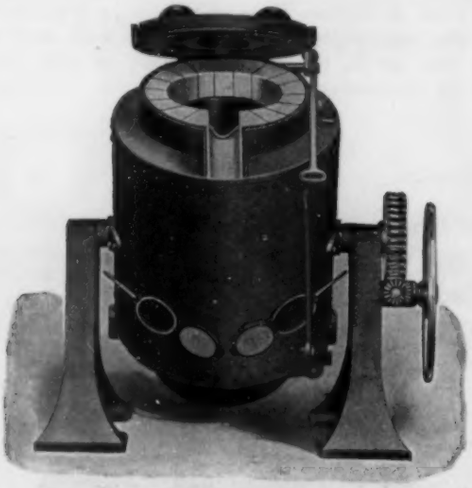


FIG. 24. REYELBEC FURNACE—GENERAL VIEW.

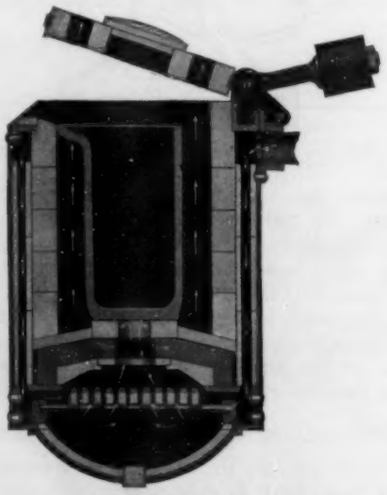


FIG. 25. REYELBEC FURNACE—SECTIONAL VIEW.

furnace, and, as shown in cut 25, consists of two shells, the inner shell, being the furnace body, the outer shell for holding and preheating the air. The shells are made of sheet steel with riveted side seams. The top and bottom are cast iron, flanged and bolted to the steel shells. The auxiliary bottom for receiving ashes and spilled metal, which works on a hinge, and is held in place by an attachment, is also flanged and bolted to the steel shells. The furnace has two grates, one for the fuel which rests on the bottom flange, and is arranged so that it not only shakes out the ashes but due to its upward and sideward motion crushes the clinkers; the other works on a hinge and supports the crucible. The steel trunnions are riveted to the shells; they rest on cast iron legs bolted to a cast iron base. The furnace is tilted by means of an ordinary hand wheel, worm and gear. The lining is made of high-grade fire tiles, laid in an inner and outer ring.

The crucibles are very much the same as the standards of corresponding numbers, except that they are higher and have less bilge, as no tongs are required to lift them out of the furnace. They are made high because less area of metal in proportion to weight is exposed to oxidation. Prices the same as standards of equal capacity. The cover consists of a circular fire tile, banded with iron to prevent cracking and to support attachment for lifting. It is attached to an automatic lifting device, which can be swung from either side. But this cover need not be lifted at all, when pouring, unless desired. This is a distinct advantage in the protection of the molten metal and is also a matter of much comfort to the operator, as he is fully protected from the open heat while pouring. Anthracite coal or coke can be used. Of the two, coke is preferable, as coke is easier on the crucible. A fan blast of one ounce is sufficient for the operation of this furnace; this is delivered by a small low pressure fan or blower, either directly connected to small motor or belt driven. The air connection is not disturbed while the furnace is being tilted.

It is claimed that the cost of melting with the Reyelbec coke tilting furnace is about half that of oil-fired crucible furnaces. This is taking into account the life of crucibles, the increased number of heats, life of lining, the average cost of the fuel, all repairs, interest on investment and shrinkage of metal. The advantage over the oil-fired crucible furnace is the elimination of noise, the siphonic action of the oil and air flame, the air compressor and the oil pumps. The absolute control of fire, perfect combustion, no oxidizing flame and no oil connection to get out of order. The increased life of crucible, the even distribution of the heat and the uniform temperature of the furnace. The superior quality of the metal and lower loss by oxidation. The advantage over other coke or coal-fed furnaces is the furnace can be tilted without disturbing the air connection, without raising the cover and the blast being continued while pouring. The air is preheated to over 1,000 degs. Fahr. before it enters the combustion chamber. No locking ring for grate bars and air supply, and no pit in floor. No cold air can attack the crucible at any time. The operation of the furnace is noiseless, because no high air pressure is used—a blast of one ounce being sufficient. Not affected in any way by weather conditions; a high, low, quick or slow fire may be had when desired. No chimney is needed; furnace under control of operator at all times.

The furnace is adapted for melting any metal which can be melted in a crucible.

The crucible need never be taken from the fire, even for charging the fuel or to clean the fire. The metal may be charged as well as the fuel without opening the door.

(To be continued.)

PATENT CONTROVERSY OVER BEARING METALS.*

Continued Discussion on this Interesting Subject.

By G. H. Clamer.†

I regret, that owing to a misunderstanding as to the date when the October number of The Metal Industry went to press, I did not forward in time for that issue, my reply to Mr. Allan's further discussion on the bearing metal situation. First of all, I wish to say that I retract in no manner, shape or form from any previous remarks on the subject, which in short were as follows:

First—Plastic bronze and Allan's metal or other similar alloys are not in the same class either from a service point of view in their properties or constitution.

Second—Allan's metal has not a melting point of 1,500 degs. as claimed by Mr. Allan, but will go to pieces if brought to the temperature approximating the melting point of pure lead, i. e., 627 degs.

Third—Allan's metal is not a homogeneous alloy in the sense that it is like one metal, as claimed by him.

Fourth—No process, secret or patented, is necessary to produce castings of copper and lead in which there shall be no segregation in pools at the bottom of the casting.

Fifth—Notwithstanding Mr. Allan's assertion to the contrary, it is a well established scientific fact that the critical point exists in the copper-tin alloy where the proportions are approximately 91 per cent. copper to 9 per cent. of tin.

Sixth—Advantage has been taken of the knowledge of this critical point in the constitution of copper-tin alloys for the production of a series of meritorious alloys of copper and tin containing a high percentage of lead which are suitable for solid bearings.

Seventh—Andrew Allan, Sr., did not invent the series of alloys to which plastic bronze belongs.

Having now set forth, in abstract, the foregoing statements, I will discuss them in their order in as concise a manner as possible within my limited power.

First—Let it be firmly understood that plastic bronze is a copper-tin alloy containing lead. Allan's metal is simply copper containing lead. Both alloys are entirely mechanical so far as their lead content is concerned, i. e., in plastic bronze the lead is distributed in tiny pools within the copper and tin matrix in which the copper and tin are in certain definite proportions. In Allan's metal, the lead is distributed in a matrix of pure copper.‡ Therefore from the very nature of the matrix, it is not to be supposed that Allan's metal is at all suitable as a substitute for bronze for solid bearings, but is primarily intended as a substitute for babbitt metals for linings. In fact no claim is made by Mr. Allan that his metal is a substitute for bronze. Its uses are therefore different owing to its properties, i. e., lack of strength and greater plasticity as compared with plastic bronze. Its constitution is different in that it has no strength giving tin in the matrix which supports the load.

Second—In the fourth report of the Alloys Research Committee was published a diagram, here designated as Fig. 1, which shows the cooling curve of a copper lead alloy. This diagram proves conclusively that lead dissolves but slightly in copper, and copper but slightly in lead, also that there is no true eutectic mixture formed by the combination of these two metals, the copper in such an alloy being almost in an entirely free condition commences to solidify at the solidifying point of pure copper, i. e., 1,937 degs., and owing to the lead which is dissolved in it continues to solidify at a decreasing temperature until the temperature of approximately 1,750 degs. is reached, when the entire amount of copper solidifies with the small amount of lead which it holds in solution. At this temperature there remains in a liquid condition, the almost pure lead, i. e., lead having in solution but a small percentage of copper, and this will not solidify until the temperature approximating that of pure lead is reached. Consequently, the strength of the alloy is limited to temperatures below this. Mr. Allan's claims, therefore, that his alloy solidifies as a whole at 1,500 degs. is not correct.

This is easily demonstrated by heating a piece of this Allan metal but slightly above the melting point of pure lead and striking it a very slight blow. It can then be seen that its strength is practically null.

Third.—Allan's metal consists, as above stated, of a network or matrix of copper and pools of lead. The photo-micrographs displayed by Mr. Allan in the September number of The Metal Industry, although

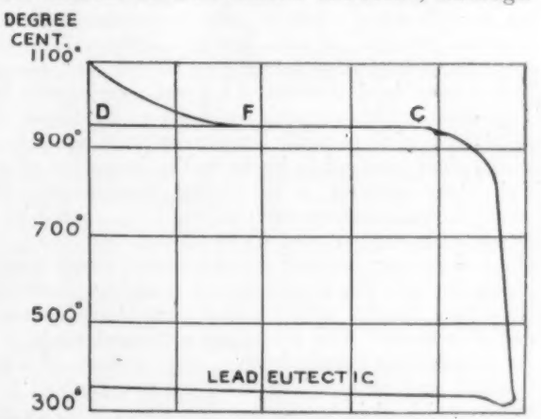


PLATE I.

he evidently is of the opinion that they prove his claims that his alloy is in reality like one metal, on the contrary prove quite the reverse, and confirm the statement as made by me that it is not a uniform mixture in the sense that it is like one metal. Although his photo-micrographs are but magnifications of sixty-five diameters, they distinctly show the matrix and pools of lead. The micrograph described as polished only, has not been polished sufficiently to bring out in proper relief the matrix, and his etched specimens have been rather deeply etched, but still show plainly the two constituents and further show an un-uniform matrix (the matrix containing tin in greater proportion than 9 per cent. of tin to 91 per cent. of copper), the hard compound Sn. Cu. 4 being plainly visible.

Fourth.—As I stated in my previous communication, copper and lead can be held in fairly uniform condition in a casting without resorting to other than ordinary foundry methods of melting and pouring, and I am confirmed in this by Mr. Vicars in the September number of The Metal Industry. In fact, any one who cares to prove my assertion can do so without difficulty. The only precaution necessary is to pour at as low a temperature as possible to run the metal. When so cast no pools of lead will segregate to the bottom of the castings, or to use a shop expression, they will not show "lead sweat."

Fifth.—Messrs. Haycock and Neville in their paper

*Began in July, 1909.
†Secretary Ajax Metal Company, Philadelphia, Pa.
‡Copper holding in solution perhaps 1 per cent. of lead.

which they read before the Royal Philosophical Society of London in 1903, describe an elaborate investigation as made by them covering the constitution of copper-tin alloys. This work up to the present time stands undisputed and has been accepted by the most prominent experts in metallography. Messrs. Haycock and Neville are both fellows of the Royal Society and scientists of high standing.

Sixth.—Practical advantage of the existence of this critical point in the constitution of copper-tin-lead alloy was taken by Mr. J. G. Hendrickson and myself in producing high lead alloys which are sufficiently strong to be used in service of solid bearings. We do not claim that tin is essential to hold the lead. As above stated, we are perfectly familiar with the fact that high percentages of lead can be retained in pure copper matrix, but we did discover the amount of tin which could be present in such matrix, without segregating the lead when it existed in proportions exceeding to any extent the limit as claimed in our patent, i. e., 20 per cent.

Seventh.—As I said in my previous communication, Andrew Allan, Sr., probably was the first to produce a copper-lead alloy on a commercial scale as a substitute for babbitt metal, that is, alloys containing as high as 40 or 50 per cent. of lead, but it is quite well known that copper and lead in proportion of 80 per cent. copper and 20 per cent. lead were used a great many years ago for large type. This metal is referred to by Brant as "pot metal." I wish to again emphasize that no claims have at any time been made by us to the invention of copper-lead alloys without a hardening constituent. We do however, manufacture such alloys, i. e., containing 40 to 60 per cent. copper and 40 to 60 per cent. lead. These alloys, however, are not manufactured under any rights which we have due to our patent covering plastic bronze. They are simply alloys which any foundryman is at liberty to make. The following statement made by us in our circular on plastic bronze—"by means of a process invented and patented in 1900 we are enabled to alloy copper and lead in any proportion either with or without tin," is construed by Mr. Allan to corroborate the fact that we claim protection for alloys of copper and lead only. In this connection, I wish to say that we were granted two patents in 1900:

First—Covering the alloy of copper-tin-lead in which the amount of tin is limited as above described.

Second—Covering alloy of copper-lead and nickel. In both cases it will be seen there is a hardening constituent present. As the relations existing between the patents which cover the copper-tin-lead alloy within the proportions of our plastic bronze, copper-lead-nickel, copper-tin-lead-nickel alloys and simply copper-lead alloy, such as Allan's metal, was exhaustively discussed in the expert testimony which was taken in our recent suits for infringement on our plastic bronze patent, if at this late day Mr. Allan attempts to extend the scope of his invention to cover plastic bronze, he is simply expressing his own evidently and necessarily prejudiced opinion against that of a U. S. Circuit Court and an U. S. Circuit Court of Appeals, both of which reviewed the exhaustive testimony discussing the relationship of these various alloys. The only new point brought up by Mr. Allan in his discussion is his attempt to prove that segregation of lead is not dependent upon the amount of tin present in a copper-tin matrix, and in order to prove his point, he has made alloys of the following compositions:

No. 1.		No. 2.	
Copper	63.00	Copper	58.00
Lead	27.50	Lead	32.00
Tin	9.50	Tin	10.00

In the first composition the tin is in proportion of 15 parts to 85 parts of copper, and in the second 17 parts of tin to 83 parts of copper, both of these mixtures being made by Allan process, which, as I showed in my previous communication, in all probability consists of the addition of a small percentage of sulphur and bismuth.

No secret process or practice other than ordinary foundry practice is necessary for the manufacture of plastic bronze, the patent covering simply the proportions of the metals. If, therefore, Mr. Allan is by means of a certain process enabled to alloy lead in presence of higher percentages of tin, he is entitled to the credit of a new invention. Not having any specimens which Mr. Allan has produced in the form of merchantable castings, I am not in a position to discuss them. By merchantable castings is meant a casting in which no pools of lead or imperfections exist at the bottom of the casting. I am perfectly familiar with the fact that lead, tin and copper can be mixed and lead held in suspension in small and rapidly chilled castings without adhering to any particular proportions of copper and tin, but have never seen castings produced in a commercial way which will vary widely from the proportions of our plastic bronze patent without showing what is commonly known in the foundry as "lead sweat."

AMERICAN CHEMICAL ELECTRO-CHEMICAL SOCIETY.

The society held its sixteenth general meeting in New York, October 28, 29, 30, 1909, with an attendance of over 300 at the various sessions.

The sessions for business were held at the Chemists' Club, 108 West Fifty-fifth street and the reading of papers took place at Earle Hall, Columbia University. General Officers of the Society.—President—L. H. Backeland, Yonkers, N. Y. Past Presidents—C. F. Burgess, Madison, Wis.; E. G. Acheson, Niagara Falls, N. Y. Vice-Presidents: C. P. Townsend, Washington, D. C.; Chas. A. Doremus, New York City; W. R. Whitney, Schenectady, N. Y.; F. J. Tone, Niagara Falls, N. Y.; Carl Hering, Philadelphia; W. D. Bancroft, Ithaca, N. Y. Managers—E. F. Roeber, New York City; L. Kahlenberg, Madison, Wis.; S. S. Sadtler, Philadelphia; E. R. Taylor, Penn Yan, N. Y.; F. A. J. Fitz-Gerald, Niagara Falls, N. Y.; A. von Isakovics, Monticello, N. Y.; S. A. Tucker, New York City; W. L. Miller, Toronto, Canada; W. H. Walker, Boston, Mass. Treasurer—Pedro G. Salom, Philadelphia. Secretary—Prof. Jos. W. Richards, Lehigh University, South Bethlehem, Pa. The papers read and discussed at the session included the following;

"The Preparation of Silundum," S. A. Tucker, H. F. Kudlich and E. M. Heumann; "The Laws of Electrode Losses in Electric Furnaces," Carl Hering; "Furnace Electrode Losses," C. A. Hansen; "Electrode Losses and Furnace Efficiency," E. F. Roeber; "A New Method of Measuring Mean Thermal and Electrical Conductivities of Electrodes," Carl Hering; "The Practical Conductance of Electrilytes," Jos. W. Richards and W. S. Landis; "A New Theory for Corrosion," Maximilian Toch; "Evolution and Present Status of the Dry Cell," J. W. Brown; "Dry Cells Tests," F. H. Loveridge; "Some Characteristics of Dry Cells," C. F. Burgess and Carl Hambuechen; "The Manufacture of Air-Saltpeter by the Process of the Badische Anilin and Soda Fabrik," Dr. C. Schönherr; "Power for Electrolytic Copper Refining at the Buffalo Smelting Works," W. L. Spalding; "A Process for Simultaneously Cleaning, Annealing and Zincing Wire by Electro-chemical Cementation," Alfred Sang; "Notes on Zinc, Copper and Brass Dusts," Alfred Sang; "Alloys of Copper with Electrolytic Iron," C. F. Burgess and James Aston.

THE CHEMISTS' RELATION TO THE COPPER AND BRASS INDUSTRY.*

By Ernest A. Lewis.

(Concluded from October.)

Discussion.

Mr. J. M. Levy pointed out, in connection with the assay of copper materials at the smelters, that one generally required to know the percentage of copper very rapidly to control the furnace working. One had to to use either the cyanide assay or the rapidly rotating electrode. Many smelters still relied on the cyanide assay as being sufficient to give a good idea of the amount of copper in the matte during the furnace run. He regarded the use of zinc for separating copper as an extremely good method. He had done a fair amount of work on this method; it had an advantage in that one was enabled to do two assays at once, if one had to estimate iron as well as copper. The iron could be determined at once, and the reduction of iron acted as an indicator, for when the iron was reduced all the copper had been precipitated. Would not Mr. Lewis recommend the ferric chloride method in precipitating arsenic and antimony as the arseniates and antimoniates of iron instead of the prolonged complex distillations?

Mr. A. E. Johnson said he preferred the electrolytic method with rotating electrodes for determining copper, zinc and nickel, both on account of its rapidity and accuracy. Mr. Lewis mentioned in his description of the arsenic distillation method that no thermometer was needed, but if antimony were present, and one did not carefully watch the distillating flask, it was liable to go up to such a temperature that the antimony would come over and would then be titrated as arsenic to give high results. He testified to the usefulness of the suction method for filling burettes by clamping each burette to a bottle and arranging it that the solution might be sucked from the bottle. This method saved much time. Why did Mr. Lewis separate the copper in estimating manganese and iron in manganese bronze? Why not take a large quantity, separate out the tin and lead in the way done for brass, then precipitate the iron and manganese together by ammonia, filtering off and estimating them separately after resolution and re-precipitation from the combined precipitates?

Mr. F. H. Alcock said that thiosulphate solutions weaker than 40 grms. per litre did not keep at all well. It was thought that the decomposition was set up by sulphur-loving bacteria. The addition of a few drops of carbon bisulphide improved its keeping properties. He kept his decinormal solution in a stoppered amber-colored bottle and in the dark. The starch solution mentioned would keep six months or more if a little benzene were added to the mucilage at the time of making. A mixture of potassium iodide solution and starch mucilage would not keep; it would quickly develop a blue color, but with a little benzene it would keep for at least three years. Had. Mr. Lewis met the presence of cobalt in spelter? He had found recently spelter containing traces of this element, but did not know its source. Some of the methods described were rather costly. For example, in separating zinc from nickel, 100 c.c. of glacial acetic acid were used. He thought the word determination of percentage should be used in "estimation," for the latter applied more to pecuniary value. Had Mr. Lewis ever determined the amount of zinc in white metals by rendering the solution slightly alkaline with sodium bicarbonate and then adding a solution of potassium cyanide in excess as passing through the solution so prepared sulphuretted hydrogen which eliminated the zinc as sulphide? He could then proceed easily with the copper and nickel determinations.

Mr. Lewis, in reply, said that all methods of analysis in the copper trades were adopted solely from a commercial point of view, copper being a comparatively expensive metal. It might seem a barbarous method to determine moisture in copper scale by heating in a porcelain dish until all fumes are driven off, yet if scale were bought, the moisture contents of which had been determined by heating in a steam oven for five or six hours, and then sold to a smelter who removed two per cent. of oil by heating in an iron pan, each percentage of oil meant a loss of 10s. per ton. He did not know the smallest percentage of cadmium required to alter the fracture of zinc, but 0.5 per cent. turned the coarse crystalline fracture into a very finely crystalline one, and 0.2 per cent, gave quite a different fracture to ordinary zinc.

To remove nitric acid completely he always evaporated to dryness twice with fuming hydrochloric acid. In regard to the bulk of solution used in an electrolytic copper assay, when using stationary electrodes and about 1 grm. of copper, if the deposition of copper is facilitated by using a concentrated solution the deposition of impurities such as arsenic is also facilitated. There was a great difference in depositing copper from a chemically pure salt and depositing it from commercial bar copper.

Accurately graduated apparatus for the iodide assay could be obtained at rather a higher price than ordinary graduated apparatus. He used one burette for that work only. He used to keep the thiosulphate solution in a self-filling burette, and abandoned it, as it was impossible to keep the solution under the conditions necessary to keep it from deteriorating, namely, in a cool, dark place free from acid fumes; such a condition was difficult to obtain in an assay laboratory.

As regards the weighing of lead peroxide deposited electrolytically, he only estimated the small amount left in solution after separating the bulk with sulphuric acid; as it only amounted to a few milligrams it made no practical difference whether it was dried to 100 degs. C. or 200 degs. C. In the case of commercial copper containing over 0.2 per cent. of lead, he heated it at about 200 degs. C. He never estimated large quantities of lead electrolytically. It was quite true that in presence of five or six grms. of ammonium oxalate in a nickel electrolytic assay, using a concentrated solution, the deposited nickel contained carbon, but if only 1 grm. were added and the solution diluted to 250 c.c. the nickel did not contain carbon. He had noticed a deposition of carbon on the spiral. The presence of ammonium sulphate was essential to get a good deposit. The estimation of arsenic by co-precipitation with iron was doubtless necessary in the assay of ores and mattes, but was not necessary in refined copper.

Mr. Johnson's remarks about distillation of arsenic and antimony were quite correct when using a concentrated solution and very little acid, but in presence of a large amount of hydrochloric acid the arsenic came off long before the temperature is raised suffici-

*From a paper read at Birmingham meeting of the Society of Chemical Industry.

ently for the antimony to come over. In the precipitation of iron, manganese, and aluminium, together in an ammoniacal solution of copper, it was difficult to get all the aluminium out of solution, and the separation of the copper from a large bulk of iron precipitate was difficult. The copper must be separated first. He had never come across cobalt in zinc. He had not tried separating zinc from nickel and copper in a cyanide solution.

The separation of phosphorus in the tin oxide precipitate was an old process; the precipitate was fused with about 2 grms. of pure potassium cyanide for two or three minutes to reduce the tin to metal, the phosphorus forming phosphate. It was extracted with hot water and filtered into a porcelain dish, 40 c.c of hydrochloric acid added, the filtrate evaporated to dryness, and the residue taken up with a few drops of hydrochloric acid and about 20 c.c. of water; the solution is filtered, 1 grm. of citric acid dissolved in water added to the filtrate, then ammonia in excess, any precipitate formed being filtered off. 20 c.c. of magnesia mixture were then added, and the precipitated phosphate weighed in the usual wav; the total volume of solution should not exceed 150 c.c.

WORKSHOP VENTILATION AND INDUSTRIAL DISEASES OF SPECIAL INTEREST TO ELECTROPLATERS AND THOSE SIMILARLY EMPLOYED.

By Percy S. Brown.

The question of factory ventilation has been widely discussed by experts in this line of engineering work and yet after all the attempts which have been made to improve the existing conditions, we are still far from a condition approaching the ideal. Both the City and State of New York have inspectors whose duty it is to go to factories and workshops and make determinations of the carbon dioxide in the air, but although they deserve credit for enforcing the law regarding ventilation to the extent of forcing offenders to pay fines until improvements in ventilation are made, they fail to give the proper attention to other conditions which they encounter.

One of the greatest sources of danger to electroplaters, silversmiths and others employed in similar work, is the use of potassium cyanide in large quantities. Potassium cyanide is employed in hot and cold solution, usually in an open crock or tank, protected in no way, not covered by hoods, not labelled, and handled freely by everyone. How many plating establishments have hoods with good exhausts over their hot copper cyanide plating tanks? How many protect their employees from the cyanide in its crude form before it is placed in solution? How many instruct their men in the dangers of handling the cyanide? I know of a case where a plater's helper was opening a large case of cyanide and was breaking up the lumps by holding them in his hand and cracking them with a hammer. He complained because the powder flew up in his nose and made him sneeze. I cite this merely as an instance of how ignorant the men who work with this deadly poison are regarding its properties. In cases of serious illness caused by cyanide poisoning, what protection have the employees? They may be sick and lose their positions and there is no return. The employee is not held responsible and legal proceedings are seldom resorted to. As an instance of how dangerous can become cyanide poisoning contracted through the skin I quote abstracts of an article from the "Journal of Nervous and Mental Diseases," Vol. 35, No. 7, July, 1908. This article written by Joseph Collins, M. D. and Harrison S. Martland, M. D. is entitled "Disease of the Primary Motor Neurones Causing the Clinical Picture of Acute Anterior Poliomyelitis: The Result of Poisoning by Cyanide of Potassium." The abstracts are as follows:

" . . . We report herewith a case of acute inflammation or degeneration of the peripheral motor neurones, which constitutes clinically a peripheral motor neuritis, but which, however, can scarcely be distinguished from an anterior poliomyelitis. In fact, so far as the reporters of the case are concerned, it cannot be distinguished.

"The patient, an Italian, 38 years old, was admitted to the City Hospital, December 3, 1906. A brief synopsis of the history of his illness is as follows: Since coming to this country, in 1904, he had been working as a silver polisher in a hotel. The method of keeping silver bright in such estalbishments is to drop it into a solution of cyanide of potassium and then dry it. He says that his hands and forearms were in such solution so much of the time that they took on a deep brownish red color and he frequently complained of a distressing itching sensation in them. In addition to this the finger-nails were quite black. He does not know how strong the solution of cyanide of potassium was that he used, but he says that he had to be careful to keep his hands away from his nose or his mouth, for otherwise he would get very dizzy. On the seventh of September, 1906, he was seized with diarrhea which soon became very severe, the passages containing large amounts of mucus but no blood. The following day he complained of severe headache, of pain and stiffness in the back of the neck and of feeling ill. He was then taken to a hospital and it is said that for a few days he was mildly delirious and had such meningeal symptoms as stiffness of the neck, retraction of the head and sensitiveness on being handled. . . .

" . . . For upward of six months there seemed to be no indications of recovery. Then gradually the atrophied and paralyzed muscles of the upper extremity began to display slight functional capacity. In the autumn of 1907 braces were put upon his legs and now he is able to walk with the aid of crutches. . . ."

This is merely one of many serious cases of cyanide poisoning. In some instances the poisoning is indicated merely by skin eruptions, serious in many cases, and in others the entire body is affected and general breakdown follows.

Another serious form of poisoning is due to nitrous fumes from rooms where metal is dipped in mixed acids, nitric acid causing the objectionable fumes. Serious poisoning, in some cases resulting fatally, have occurred and unless good arrangements are made for exhausting the fumes the employees are in constant danger.

In buffing and polishing rooms there is always danger to the lungs if proper exhausts are not provided. Fortunately the law protects those engaged in this kind of work by making it compulsory to have proper methods of exhausting the dust.

Our State Labor Laws are good, as far as they go, but can they be properly enforced? Is the organization back of these laws strong enough to enforce them throughout

the State? Apparently it is not as we all know that the evils still exist to a great extent. To show to what extent the law empowers the Commissioner of Labor to enforce proper conditions in factories I will quote Article 86 of the laws relating to labor and factories under the head of Ventilation:

"The owner, agent or lessee of a factory shall provide in each workroom thereof proper and sufficient means of ventilation, and shall maintain proper and sufficient ventilation; if excessive heat be created or if steam, gases, vapors, dust or other impurities that may be injurious to health be generated in the course of the manufacturing process carried on therein, the room must be ventilated in such a manner as to render these harmless, so far as is practicable; in case of failure the Commissioner of Labor shall order such ventilation to be provided. Such owner, agent or lessee shall provide such ventilation within twenty days after the service upon him of such order, and in case of failure, shall forfeit to the people of the State, ten dollars for each day after the expiration of such twenty days, to be recovered by the Commissioner of Labor."

This article gives almost complete power to the Commissioner of Labor and any recommendations for improvement in ventilation can be enforced under this section of the laws. The fault in the law is not in the fact that it fails to cover the necessary points, but that it is of such a character that it is difficult to enforce. Inspectors can determine the fact that the air has become vitiated by lack of ventilation but they do not reach the evils found in many factories where there may be a minimum of carbon dioxide and yet large excesses of noxious gases. Unfortunately carbon dioxide is tested for and other things neglected. Also where the inspector arrives in a shop or factory, his entrance in the different departments appears to be "anticipated" and all windows are found open. The result is that his tests show the carbon dioxide content to be within the legal limit.

Fortunately there is a remedy which, by proper legislature, would prove both a protection to the employer and employee. This remedy consists in making the employer liable for specific cases of illness contracted by an employee, such cases of illness being contracted through fault of the employer in neglecting to assure proper protection for his employees' welfare, as required by law. An example of this form of protection is found in the recent reports of "The Departmental Committee on Compensation for Industrial Diseases" appointed by the King of England. The investigation of this committee was remarkably thorough and their findings should be on file in every municipality. The committee made their reports after exhaustive study of industrial conditions pertaining to the health of workmen, interviewing physicians, workmen, capitalists, labor organizations, etc. in the most thorough manner.

We are gradually working toward improved conditions in workshops and factories and must eventually arrive at the point where our laws will have to be brought up to date. What change could be better than to have a law by which the employer knows just what his responsibilities are toward his employees and by which the employee in turn knows that he need not fear losing his position through incapacity from work resulting directly from a specific cause covered by a compensation clause under the law. Many cases can be made specific causes for compensation as shown by the English law. Those not coming under the law would be classed as accidents and would be dealt with as heretofore. The poor workman, as a rule, never claims damages owing to his lack of knowledge of his rights, or if he does he is often bled by shyster lawyers, whether he win or lose his case, for as a rule he fails to take advantage of opportunities offered by Legal Aid Societies. These societies would find their burden considerably lightened if a law built on the plans of the English law was to be put in effect, as accident cases alone would then require their attention.

I believe that I am not too emphatic when I repeat that there is no question but that the law can be made specific enough to differentiate between cases of accident and those of sickness resulting through carelessness of either employer or employee and if the various powerful associations throughout New York State would get together and appoint a committee to investigate the possibilities of new legislation I feel confident that great progress could be made. Suppose, for instance, that the American Brass Founders' Association and the National Electro Platers' Association were to affiliate in this matter, they could no doubt in a short time interest some of the Manufacturers' Associations in the cause and there is almost absolute certainty that by obtaining the support of the best labor organizations the Governor and Legislature could be interested enough to consider improving the labor laws on sane, modern lines.

HIGH DENSITY NICKEL SOLUTION.

By Royal F. Clark.

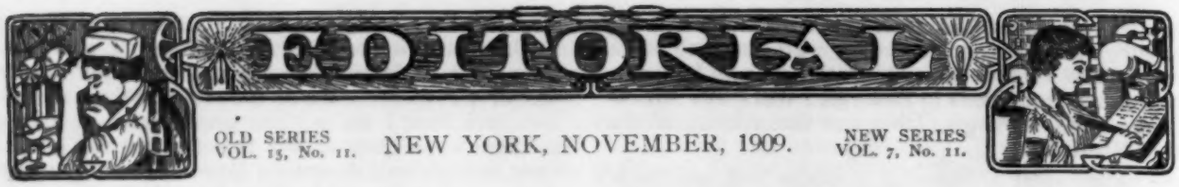
There seems to be a custom or tendency, at the present time, to operate electro-plating solutions at a low density; i. e. in a very weak state. Cyanide copper baths usually register 8 to 10 degs. B., brass 10 to 12 degs., nickel 4 to 6 degs., silver 12 degs., gold 4 degs., and acid copper 18 degs. B.

In some plating rooms the solution stands less, in others more than the above figures. But taking the average or standard figures they are as follows: Bright copper (cyanide) 10 degs., bright brass 12 degs., nickel 6 degs., silver 15 degs., gold 6 degs., acid copper 18 degs. B. A good white nickel bath registers between 7 to 9 degs. B. It can be run as high as 10 degs. Reference is made to still solutions, it being understood that barrel plating solutions must be of a very high density.

Some platers will make up their nickel baths to register about 6 degs. B., never add any counducting salt other than the sulphate of ammonia which is one of the ingredients of the double sulphate of nickel and ammonium salts. They keep up the metal contents of the bath by adding only double nickel salts. Other platers add only single nickel salts when replenishing. The nickel bath herein described is one which I have used with excellent results. The deposit obtained is very white. The formula is as follows:

Double nickel salts	8 ozs.
Single nickel salts	2 ozs.
Water	1 gal.
Salamoniac (powdered.)	1 oz.
Common salt	3 ozs.
Boracic acid (crystals)	2 ozs.

The last three named chemicals are added to increase the conductivity of the solution, and also to whiten and soften the deposit. I have operated still baths of the above formula which stood 10 degs. on the Baume hydrometer, and mechanical tumbling barrel plating solution standing 12 degs. B. The work comes out of the bath having a dead white appearance and being a soft deposit can be buffed to a high luster with ease. The salt and boracic acid, while they act as conducting agents, also have the power of softening and whitening the deposit. It is surprising how white a nickel deposit can be had from the above bath. A current of between 2 and 2½ volts should be used.



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CONTENTS

THE UTILITY OF THE INSTITUTE OF METALS

The Manchester Meeting of the Institute of Metals has given further proof—were such required—of the great field of usefulness lying before the youngest of our scientific societies. The freedom with which papers of both practical and academic interest are being presented to the Institute, as well as the keenness of the discussion that follows the reading of these papers gives an indication of what a fount of information has been tapped through the medium of the new Institute. The papers read covered ground quite different from that investigated at the Birmingham and London Meetings of the Institute, and it is to be hoped that the excellent standard set at the first three Meetings of the Institute will be maintained.

A consideration of the alloys of aluminum-copper-tin formed the basis of a very interesting paper presented by Messrs. Edwards and Andrew. These three metals were chosen because alloys of copper-aluminum, aluminum-tin, and copper-tin had already been separately investigated, but never alloys of all three metals. Further, it was desired to see whether tin could be replaced by aluminum in brasses and other alloys, as was suggested by Mr. W. H. Johnson at the London Meeting of the Institute. The experiments clearly proved that an alloy containing 92.5 per cent. copper and 7.5 per cent. aluminum whilst possessing about the same ultimate stress figure, 20 tons, as that of a 90 per cent. copper and 10 per cent. tin alloy, had an amount of ductility far superior to the copper-tin in the ratio of 71 per cent. to 40 per cent elongation. It was further shown that no ternary compounds of aluminum, tin and copper exit, and also that an alloy containing about 6.5 per cent. aluminum, 5.5 per cent. tin, 88 per cent. copper is likely to have the same properties as an alloy containing 10 per cent. tin and 90 per cent. copper, such a ternary alloy being cheaper than copper-tin, and also having a lower specific gravity.

Of an essentially practical character was the paper on "The Surface Appearance of Solders," published in this number of THE METAL INDUSTRY, by Mr. C. O. Bannister, who showed the surface effects of adding to a normal 50 tin—50 lead tinman's solder small percentages of a third metal. Antimony and bismuth seemed to be the least objectionable foreign elements, the latter, up to one per cent. having no effect, whilst two per cent. of the former was found to improve the appearance of the tin-lead alloy. It was noted, however, that more than 2 per cent. of antimony caused the segregation of a compound of tin and antimony with the consequent roughening of the surface. Copper, even 0.10

per cent caused blisters, dulness and crystalline structure, the proportionate effect of copper being much greater than that of antimony. Silver, in all percentages, caused the solder to whiten and become crystalline, though it remained tough. The most deleterious element in solders, it appeared, was zinc, of which even a trace would cause serious blisters on the surface of the solder.

The metallurgy of zinc received attention at the hands of three authors, Mr. H. W. Greenwood and Dr. Brislee jointly discussing "The Technical Assay of Zinc," and Mr. J. S. Glen Primrose giving some useful "Notes on the Production of Pure Spelter." Papers on the analysis of the non-ferrous metals are always interesting to those who are responsible for the output of a works or to those who may be engaged in any form of scientific examination of metals. Whether the methods of analysis proposed by any investigator meet with general approval or not, it is always good that they should be carefully examined and tested, for in this way still more satisfactory methods may be evolved. Messrs. Greenwood and Brislee's paper describes various methods of zinc analysis by the volumetric, gravimetric and electrolytic methods, and has as its object the determining of the relative value for technical purposes of these various methods, as well as the gathering together of the more important references, (in both British and foreign scientific literature) to the analytical chemistry of zinc. Mr. Primrose's paper was also of a practical character, and described particularly the methods adopted in large works of purifying zinc from those metals—lead, iron, cadmium, and tin—which are commonly associated with spelter. The paper would seem to show that the new method of fume filtration described by the author provides a satisfactory way of removing impurities, whilst being both simple and inexpensive.

Brass considerations entered into the composition of two papers, one being by Mr. E. L. Rhead on "Notes on Some Probable Causes of the Corrosion of Copper and Brass," published in this number of THE METAL INDUSTRY—a large subject—and the other a joint contribution of Professor Turner and Mr. M. T. Murray on "The Copper-Zinc Alloys—A Study of Volume Changes During Solidification." The latter contained a mass of information useful to the brassfounder and described an instrument—the extensometer—which should soon form as integral a part of the modern brassfoundry as does the pyrometer.

An account of a novel piece of research work on the "Elastic Breakdown of Non-Ferrous Metals," was presented by Professor C. A. Smith, whose instrument, the sphingometer, enabled him to conduct a most interesting series of tests on ductile metals under combined compression and torsion. Quite new ground was broken as a result of Professor Smith's investigations on these lines upon copper, brass, aluminum, and Muntz metal, and it is pleasing to note, as indicating the growing interest of the manufacturer in matters that not long ago would have been considered merely of academic interest, that firms of such eminence as the Broughton Copper Company, Ltd.; Grice, Grice & Son, Ltd.; the British Aluminum Co., Ltd., and the Muntz Metal Co., have actively assisted Professor Smith in his investigations. The results seem to show that ductile materials—as a whole—fail in accordance with no definitely recognized laws, but that Muntz metal and copper fail under combined compression and tension almost exactly as does mild steel, thereby coming under the shear stress theory. A remarkable point brought out was that aluminum became more elastic as a result of overstrain, and also that the metal fractured in tension in exactly the same characteristic way as is the case with cast iron in compression.

NEW BOOKS

Metal Spinning. By Fred D. Crawshaw, M. E. Practical instruction in a fascinating art. Size, 5 x 7 inches; 75 pages; with numerous illustrations. Price 25 cents. Popular Mechanics Handbook No. 2. Popular Mechanics Company, Chicago.

The book contains seven chapters devoted to the spinning of metals, beginning with a description of the tools used and closing with examples of finished work. This is the only book published in the interests of metal spinning.

While small and concise, the information given is most valuable for not only manual training schools, but also the amateur and professional metal worker.

Gas Engine Theory and Design. By A. C. Mehrtens, M. E., Instructor in Mechanical Engineering, Engineering School of Michigan Agricultural College. Size, 5¾ x 8¼ inches; 256 pages and 68 illustrations. Price $2.50. John Wiley & Sons, New York; Chapman & Hall, Ltd., London.

To the men who operate gas engines, the students, draughtsmen and engineers who are interested in the theory and why of the gas or heat engine, this book should prove extremely valuable. The text being fully illustrated with figures and diagrams of the simplest nature makes the treatment of the subject as clear and concise as is possible without slighting the subject. The book consists of twenty-one chapters and eight tables; the chapters on fuel and combustion being especially good and readily understood by one not versed in the technical knowledge of these phenomena. The reason for the existence of the book being that there were no suitable text books to be found proves the merit of the work and ensures for it a permanent place among scientific books.

The Precious Metals: Comprising Gold, Silver and Platinum. By T. Kirke Rose, A. R. S. M., D. Sc., Chemist and Assayer of the Royal Mint. Size, 6 x 8¼ inches; 295 pages; 46 illustrations. Price $2.00. D. Van Nostrand Company, New York, 1909.

This book has been prepared with the view of providing an introduction to the study of the precious metals, and also a book of reference for those who do not desire to go into the subject deeper. The book treats in a very clear and interesting manner of the history, extraction from the ore, refining and alloying of the precious metals, gold, silver and platinnm.

There are two chapters devoted to the assaying of gold and silver ores and bullion. There is also a full description of minting and the manufacture of gold and silver wares, with directions for the handling and treatment of the metals in the processes of manufacture.

Heretofore it has been customary to term only gold and silver as "precious," but as platinum has now come into more common use, and is more valuable than gold by weight, this latter metal is included in the book and is treated similarly to gold and silver. There is included statistics giving the world's production of these precious metals. Taken as a whole, the work will make a valuable addition to anyone's library and particularly so to those interested in the study and use of the precious metals.

CRITICISM AND COMMENT

WE CORDIALLY INVITE READERS' OPINIONS AND CRITICISMS OF ALL ARTICLES PUBLISHED IN THE METAL INDUSTRY. SUGGESTIONS WELCOME.

MODERN METHODS FOR RUST-PROOFING GUN BARRELS, ETC.

To The Editor of THE METAL INDUSTRY:

In reference to the article by Alfred Pritchard on "A New Process For Rapidly Oxidizing Iron and Steel," published in the October METAL INDUSTRY, I have the following to remark:

On first reading, this article struck me as being similar to other formulas which I have seen before and I find upon investigation that it is merely a modification of different approved methods of rust-proofing gun barrels, ordnance, etc. Some time ago a patent was issued to a Frenchman named Thierault for a solution of this character which is composed of about the following ingredients:

Solution 1—Mercury bichloride and ammonium chloride.

Solution 2—Copper sulphate, ferric chloride, nitric acid, alcohol and water.

Solution 3—Ferrous chloride, nitric acid and water.

Solution 4—Potassium sulphide.

A description of this method states that these solutions shall be applied in succession, being dried after each application, said applications to be continued for three times. On applying solutions 3 and 4 the material is boiled in water and then dried. This is done on all three applications. The material is then scratch brushed and oiled. The alcohol used in this formula is merely to hasten the drying. I understand that at one time this formula was used considerably on French ordnance.

Another formula of a somewhat similar nature is composed of nitric acid, iron chloride, alcohol, nitric ether, copper sulphate and water. The description states that the solution shall be applied to the material with a sponge, shall then be cooled for ten hours at 50 to 60 degs. F., then warmed at about 70 to 90 degs. F. until dry and then rubbed down with a scratch brush with lard and boiled for ten minutes in water, wiped dry, cooled and scratch brushed. This operation is repeated from two to six times, depending upon the thickness of the coat required. It is finished with oil.

Another formula which has been used to some extent consists of applying a solution of iron chloride, copper sulphate, nitric acid and water, drying at 86 degs. F., placed over boiling water for twenty minutes, again dried at 86 degrees F. and scratch brushed. This operation is repeated a number of times and the material is then oiled.

It will be noted that all of these formulas are more or less similar and apparently are all derived from the same source, being merely modified by various operators. Mr. Pritchard's formula and his method of procedure is probably another modification. One change which he makes, however, is the addition of hydrochloric acid which I do not believe would have very much effect one way or the other in his formula. I can see no reason why this method of obtaining a gun metal finish should not prove satisfactory for the class of work upon which it is intended, inasmuch as it has been used for gun barrels, etc., and although I never have personally investigated any of these formulas I can see no reason to doubt that they would prove satisfactory to a certain extent.

Louis E. Andes, in his book on "Iron Corrosion," page 247, comments on various so-called scale protections for iron and cites the fact that the principal objection to iron protection of this character is that the tendency of the scale to chip offers a great disadvantage. I have found this to be so, especially on Bower Barffed surfaces and I know of very few methods of rust protection depending on the formation of a scale which are not open to the same criticism. Aside from this there are no serious objections to this method of protecting iron.

There is a method of this kind which has been used to some extent which is much cheaper than that described by Mr. Pritchard and requires less care in performing, but I am not certain that it would stand up against his method as a rust protector. This method consists of immersing the iron or steel in a solution composed of bichloride of mercury, copper chloride, bismuth chloride, hydrochloric acid and water. A film is deposited on the material and the material is then rinsed well and dried. It is then placed in a muffle furnace and heated to a low red heat and immediately removed and cooled slowly, paraffine or oil being applied while the material is still warm. The finish obtained by this method is exactly similar to the Bower Barff finish, or the gunmetal finish, depending on whether the material has been sand blasted or polished.

You will note that I have made few comments on the actual method suggested by Mr. Pritchard other than to compare it with other formulas, and aside from this there is very little to criticise in this method.

PERCY S. BROWN.

GUN METAL FINISH ON IRON AND STEEL.

To the Editor of THE METAL INDUSTRY:

On page 372 of the October issue of THE METAL INDUSTRY is published an article on "A New Process for Rapidly Oxidizing Iron and Steel," by Alfred Pritchard. We are told that this alleged new process has been evolved "after many untiring efforts" of the author. This claim will be a great surprise to the gunsmiths and other workers who have been using ferric chloride solutions for producing the gunmetal finish for many years. The black oxide of iron as a finish for steel and iron is ancient history and Mr. Pritchard's process presents no new features. While he may have stumbled on the process independently, it is very old indeed, and metallurgical history fails to record who first used it.

Solutions containing ferric chloride, nitric acid, hydrochloric acid and copper sulphate, are given in Steele & Harrison's "Gunsmith," published some thirty years ago. Standage's "Decoration of Metal" gives several, mostly comprised from older works, the chief ingredient being ferric chloride. In Hiorn's "Metal Coloring" is also found similar formulæ for producing the gunmetal finish.

Solutions containing ferric chloride, and the whole process including steaming, hot water treatment, scratch-brushing and oiling is employed today in many shops for producing the gunmetal finish on gun barrels, bit braces, chisels, carpenters' squares, draw knives, dividers' pliers, etc. The modern solution for producing this finish is more simple in composition than that given by Mr. Pritchard and will produce equal results on hardened and annealed work. Honor to whom honor is due. It would be interesting to hear from some of the old gunsmiths as to the origin of this process.

GUNMETAL.

REDUCTION OF LEMELS.

In the September number of THE METAL INDUSTRY, on page 331, in the article compiled by J. Horton from the paper of T. J. Montford on "Metallurgy for Jewelers," our attention has been called to what appears to be an error in compilation, and in character may have caused some of our readers embarrassment. The sentence where this occurs is as follows:

"In dealing with 'Lemels' or filings and sweepings from the men's boards various fluxes are used, the chief being KNO_3.

"The fluxes are mixed with the lemel and all run down in a skittle pot, more flux being added, until by the action that is taking place it can be seen that the copper and silver, with all impurities have been taken up. If this is done properly the lump usually assays about 23 karats fine."

The first sentence of the above paragraph should read: "In dealing with 'Lemels' or filings and sweepings from the men's boards, there are a number of different fluxes and mixtures of fluxes used, of which the principal constituent is nitrate of potassium or saltpetre (KNO_3)," etc. Without this explanation it would seem as though saltpetre is recommended to be used as a flux by itself.—ED.

Shop Problems

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE OF THE METAL INDUSTRY. ADDRESS THE METAL INDUSTRY, 61 BEEKMAN STREET, NEW YORK.

ALLOYING

Q.—Kindly answer under Shop Problems giving the best formula for an alloy for use as a cutting block, on which sharp knives under heavy pressure, fall several hundred times daily. I need an alloy with aluminum in it, that will be tough, fibrous and fairly cheap.

A.—The information you furnish is not very specific as regards the exact conditions that the cutting blocks must meet but the use of lumen bronze blocks ought to prove satisfactory. It is cheap hard and nonfibrous. The formula is:

Zinc	86.
Copper	10.
Aluminum	4.

As the manufacture of this alloy is difficult we recommend, that you obtain it from the maker.—J. L. J.

ANNEALING

Q.—We are having trouble in annealing brass shells such as are used for bedstead trimmings. Red spots appear on the shells after the first annealing and will not pickle out and are only temperarily removed by buffing. What is the cause?

A.—The reason your shells turn red is because the copper in the brass has been oxidized or burned. In annealing brass is best to keep it away from the air while it is being heated. If you do not care to buy a special annealing furnace you might try covering the articles with sawdust, bringing them up to a dull red heat, then cover them completely with sawdust and allowing them to cool off slowly.—J. L. J.

BUFFING

Q.—In buffing white metal and German Silver waiters. I am having difficulty to eliminate grooves and half circle marks that are in the metal before I get it. How can I overcome it?

A.—You can overcome your difficulty by sand-buffing the articles. This is accomplished by using a sewed buff producing a hard wheel of about 1½ to 2-inch face. Use a speed of about 1500 revolutions per minute. Use Connecticut sand or any good grade of red sand which may be procured through platers supply houses. A box should be made to contain the sand and placed beneath the buff wheel with sides and back sufficiently high so all the sand will fall back again into the box.

The operation of sand-buffing is accomplished by putting the sand upon the articles and going over the surface as in buffing. This is carried on until all marks or indentations are buffed out, when the regular method can be used. The advantage of sand buffing especially upon soft metals is that the metal is kept cool and there is less danger of burning the surface.—C. H. P.

CONDUCTING

Q.—I notice in all recipes for a cyanide copper solution, carbonate and bisulphate of soda are used. Would like to know the object in using those ingredients, as I have used cyanide copper solutions without them and had just as good results.

A.—Carbonate and bisulphate of soda are used primarily as conducting salts, that is, they reduce the internal resistance of the bath. Nearly all platers concede that better results are obtained where sodas are used in connection with the cyanides, in brass and copper baths. In brass plating iron, carbonate of soda produces a cleaner deposit. Bisulphate of soda effects the reduction of cuprous sulphate, which is very soluble in cyanide, and it will be found that when sufficient is maintained in a brass or copper bath less cyanide can be used, and the anodes never become coated with the basic carbonate of copper.—C. H. P.

FINISHING

Q.—Kindly let me know if there is any way of finishing lead castings to give them a bright, desirable color other than nickel or silver plating?

A.—Lead castings can be copper-plated in an acid copper bath or tinned in a solution of:

Water	1 gal.
Caustic soda	8 ozs.
Fused Chloride of tin	3 ozs.

Use a cold solution or nearly so and anodes of pure tin. To produce a luster, scratch brush with a fine crimped steel wire scratch brush. The acid copper solution should consist of:

Sulphate of copper	1¾ lbs.
Sulphuric acid	3 ozs.
Alum	2 ozs.
Water	1 gal.

Use anodes of soft sheet copper. The copper may be plated direct on the lead.—C. H. P.

Q.—Please give me a good rose gold solution, also a dark antique green gold for the sample I send you.

A.—To produce a cheap rose gold finish, copper plate in a cyanide of copper bath using a strong current to produce a dark reddish tone, then relieve the high lights, then flash in a rose gold solution made up as follows:

Water	1 gal.
Carbonate of soda	2 ozs.
Yellow prussiate of potassium	2½ ozs.
Chloride of gold	½ oz.

Use a strong current and pure gold anodes. Platinum or iron anodes may be used, if metal is constantly added to the bath in the form of chloride of gold.

A green gold may be produced by adding sufficient cyanide of silver to produce a greenish tint from the gilding bath. Then add arsenate of soda to produce a dark green; this may be prepared by dissolving white arsenic in caustic soda, using as little water as possible, one part of soda will dissolve two parts of arsenic. Use boiling water. Add only very little of the arsenic to the green gold, otherwise the color will be too dark.—C. H. P.

MIXING

Q.—I would like to know what red and white oreide metal is composed of, and whether it will oxidize or tarnish, if not lacquered?

A.—The following oreide is said to resemble gold very closely:

Copper	100 parts
Magnesia	6 "
Sal ammoniac	3.6 "
Lime	1.8 "
Crude tartar	9 "
Granulated zinc	17 "

Another oreide mixture consists of copper 9, zinc 1. Unless well lacquered oreide will soon tarnish.—J. L. J.

Q.—Enclosed please find one dollor for subscription to THE METAL INDUSTRY for one year. Having looked your sample copy over, I find it is just what every man in the brass business should consider as his side partner. Would you kindly furnish me with

a formula for a cheap red brass such as is used in cock work or faucets and also a formula for expensive red metal?

EDWARD GUIDIER,
Supt. of Baltimore Brass Works, Baltimore, Md.

A.—For an expensive red metal mixture, there is nothing better than the well known 88-10-2 mixture. Viz:

Copper	88.
Tin	10.
Zinc	2.

For a cheap red brass for clock work or faucets you might try the following:

Copper	1 lb.
Zinc	1¾ ozs.
Tin	½ oz.
Lead	2 ozs.

Mixtures containing even less copper are generally used for this class of work and it is often made from scrap alone.—J. L. J.

Q.—I am looking for something to apply to the surface of bright steel to prevent rusting. I have been using lacquer but want something that will give better results.

A.—There are many methods in use for the prevention of rusting of iron and steel articles, but all of them have an oxidizing influence which when applied to a bright surface changes its appearance from a bluish tint to a dead black. In our opinion lacquer sufficiently diluted is as good a method as any. A lacquer for this purpose which has been found very satisfactory, consists of French Copal Varnish cut in denatured alcohol 1 parts, a thinner or reducer consisting of equal parts of fusel oil and amyl acetate 2 to 3 parts. Apply by dipping in the usual manner, dry with or without heat.—C. H. P.

PLATING

Q.—Are you acquainted with a process for the plating of wood?

A.—Copper plating on wood is accomplished as follows: The wood should be thoroughly dry, dissolve orange shellac in wood or denatured alcohol, producing a very thin varnish, ½ oz. to the pint will be sufficient. Apply one or two coats to the surface, allowing sufficient time for drying between each coat; when the last coat is thoroughly dry apply a thin coat of turpentine copal varnish; when this is tacky rub on pure copper bronze powder, using a soft brush for this purpose; see that the surface is completely covered; allow to dry, then wire up with thin copper wire for connection in the bath. The bath should consist of 1¾ to 2 lbs. of sulphate of copper, 4 ozs. of oil of vitriol, and ½ oz. of yellow dextrine in each gallon of water dissolved in boiling water and allowed to cool.—C. H. P.

Q.—We have several carloads of large cast iron plates, about 2 inches wide by 20 inches long, and some wrought iron grilles 7 inches by 7 inches, which are specified to be bronze plated 1-16 of an inch thick. We have tried to plate first in cyanide and then in duplex copper long enough to give the metal the desired thickness in plating, and finished up with a bronze plate so to have the color as specified, but this process takes too long and is too costly. Would you think a zinc plating under the the bronze would be cheaper and could be used to advantage and deposit quicker than copper?

A.—We would suggest that you try electro deposits of zinc. With a slightly agitated motion of the bath, heavy deposits will rapidly be obtained. This will surely prevent rusting as no metal gives a better protection to iron or steel than zinc. After zinc plating, if you finish in the duplex copper bath, be sure that the deposit is well covered, first in the cyanide bath to prevent local action between the zinc and the acid copper solution.

The formula for the electro zinc bath consists of:

Commercial sulphate of zinc	2 lbs.
Sulphate of alumina	1½ ozs.
Water	1 gal.

Use anodes of zinc containing one or two per cent. of aluminum. Prepare the bath and then place the anodes in position and allow to remain for at least ten hours before working, this will cause the slight amount of free acid to be taken up by the action upon the anodes. If a bright surface is required upon the zinc use soft steel wire scratch brushes for finishing.—C. H. P.

Q.—Please advise us what to use for a silver strike on steel knives and forks.

A.—Each knife or fork is strung up on No. 23 low brass wire, then taken up by the wires and washed in a strong soap and ammonia wash; if they are very greasy a preliminary wash with gasoline is used, but is not necessary. After washing, the work is dipped in a strong kalye solution (three pounds kalye to five gallons of hot water) and rinsed in cold water, dipped in the hydrochloric dip and immediately struck until a uniform coat of silver is obtained; when it is spotted or streaky the work is scratch brushed, washed and dipped in kalye, rinsed and struck again. If the blanks are iron or are very porous, it is an advantage to add an ounce of cyanide of copper to each gallon of the strike solution so a current of six or eight volts can be used without burning the work, which must be smooth and entirely covered before transferring to the tank. The cathode wires are kept in motion by an eccentric wheel to prevent the work from burning while in the tank.—O. A. H.

POLISHING

Q.—I have to plate large quantities of small steel articles. Is there any way to mechanically polish these?

A.—Small steel articles are usually polished as follows: First, in maple sawdust to remove the grease from the surface, this is accomplished by the aid of a vertical barrel and in usually from 5 to 10 hours. Then the articles are removed from the sawdust by sifting and again tumbled by the aid of leather meal (This is finely macerated leather). It is customary to add a little Vienna lime to assist in the polishing. Or the tumbling may be accomplished by the wet method, using small steel balls and dilute sal soda water as the polishing mediums. This method gives good results in one operation.—C. H. P.

SOLDERING

Q.—Will you kindly give me the composition of a good silver solder for soldering German silver sheets? One of our customers has had a great deal of trouble in making bar fixtures with German silver. The trouble is, in using ordinary high grade solder the parts give way.

A.—We would suggest that you advise your customer to try a solder known as ordinary hard silver solder, which consists of copper, two parts, and silver, three parts. This makes a very tenacious solder and can be used for soldering articles that have to undergo considerable working.

Another silver solder which is very hard consists of silver, forty parts, and copper, ten parts; and still another is, silver, forty; copper, ten; tin, ten, and two-and-one brass mixture, forty parts. If he cares to use a cheap solder containing no silver, he might try copper, forty; zinc, forty, and tin, twenty parts.—K.

TINNING

Q.—Will you kindly let me know in your next number a solution for a bright electro tin bath for sheet Iron. A solution which will not give a dull deposit resembling silver, but one which gives a bright deposit.

A.—A new formula for a tin plating bath has been recently introduced. The inventor claims far better results than with other formula. The composition consists as follows:

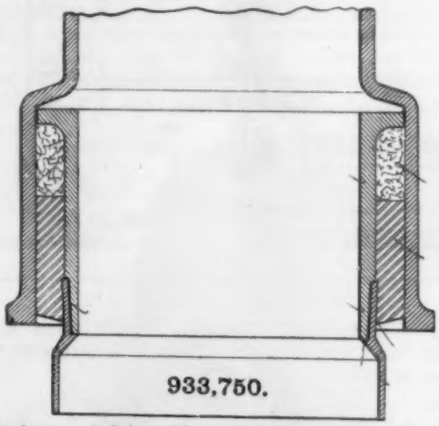
Water	1 gal.
Caustic soda	1 lb.
Hyposulphite of soda	½ lb.
Chloride of tin crystals	¼ lb.

The solution is used hot or cold. The method of preparing, is to dissolve the caustic soda in the water, then add the tin salt. When the solution becomes clear the hyposulphite of soda is added. We would advise adding ¼ to ½ ounces of molasses as a brightener. Anodes of pure tin should be used in connection with the bath.—C. H. P.

PATENTS

REVIEW OF CURRENT PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

933,750. Sept. 14, 1909. FERRULE. R. S. Gladding, Beverly, Mass. This is a ferrule for plumbers use composed of brass and iron, as shown in cut, which has all the advantages of a solid brass one. The parts are assembled by heating the brass, thereby expanding it; placing it with its lip upon and surrounding the iron lip; and allowing it to cool. Upon cooling it shrinks upon and grips the iron tightly. Preferably the iron is coated with tar or with any suitable iron cement before the brass is placed upon it. The proximity of the hot brass upon this coated surface converts the tar or cement into a liquid or pasty condition.

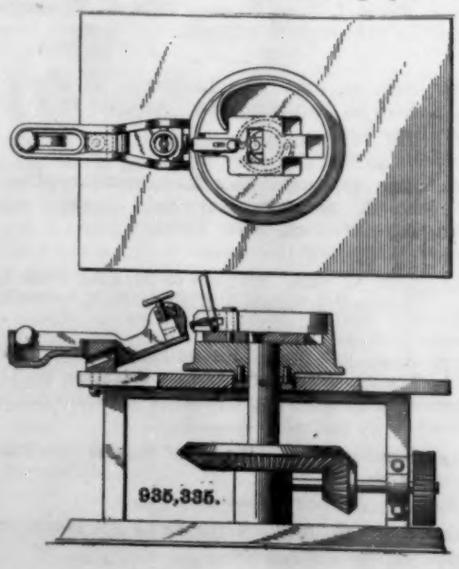


933,750.

As the brass shrinks this seeks and fills all irregularities of fit and all minute spaces between the iron and brass; and solidifies when cool, forming a packing which prevents all leakage. The brass is thus strongly united to the iron, the iron being under compression and tending to expand, and the brass being under tension and tending to contract upon the iron. Both because of this mechanical union, and also because of the packing between, the joint is tight.

935,335-6. Sept. 28, 1909. WIRE DRAWING MACHINE. (Two patents.) Hugh L. Thompson, Waterbury, Conn.

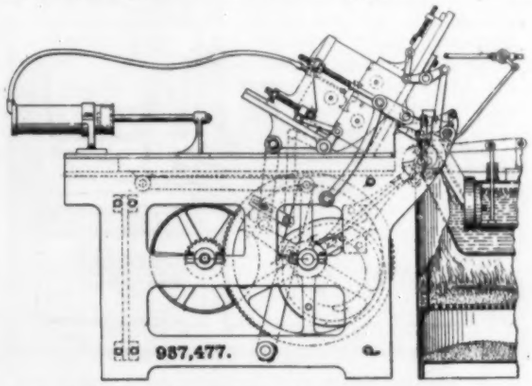
The object of this apparatus shown in cut is to furnish means for securing a radial start of the wire drawing operation which shall finally be transmitted into a tangential drawing, at maximum speed of the block, so that the first operation of the device is to cause a comparatively slow preliminary movement of the wire through the die, sufficient to start the flow of the metal, after which the wire is laid upon the periphery of the block and the full speed of drawing then proceeds. In this way a higher speed of drawing is made possible, than would be the case were the drawing operation begun tangentially with respect to the block since the sudden start of the drawing would cause the breaking of the wire.



935,335.

The second patent issued under this head covers means for securing the wire and provides for a gradual drawing-out operation before laying the same on the periphery of the block, whereby the rotation of the block may be begun at maximum speed without danger of snapping the wire by the sudden starting of the drawing operation.

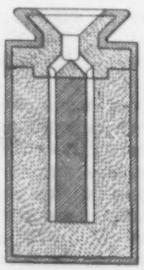
937,477. October 19, 1909. CASTING APPARATUS. Isaac Shönberg, New York, N. Y. The apparatus shown in cut is designed for the purpose of effecting a sequential operation involving the closing of the separable mold and its approach to the casting



937,477.

spout, the locking of the mold parts or sections together and to the spout, the injection of molten metal into the mold, the separation of the sprue from the casting in the mold cavity and the withdrawal of the filled mold, and finally the separation of the mold sections. This cycle of operations being repeated continuously during the running of the apparatus.

936,713. October 12, 1909. METHOD OF PLATING METALS. William Griffith, Pittsburg, Pa. This is an improvement in the art of uniting or welding metals, more particularly to coating or plating of metals with other metals, such as iron or steel with copper, brass, bronze, nickel, aluminum, or other metal or alloy; and it consists, generally stated, in first subjecting the metal to be coated to a cleaning and other prepatory treatment and then applying in molten form the metal adapted to form the coating or plating, as will be hereinafter more fully set forth.



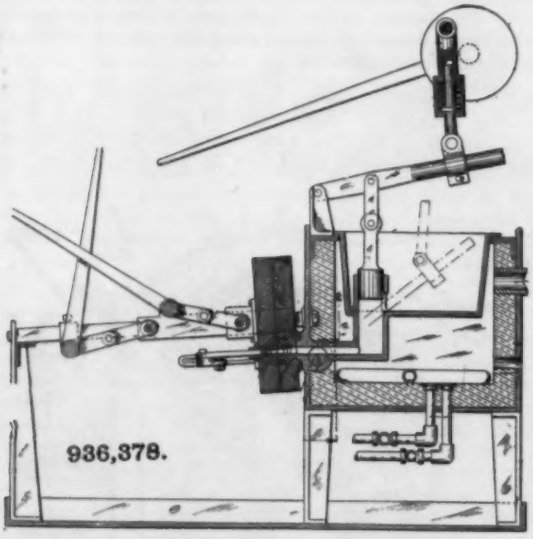
936,713.

In carrying out the invention, the iron or steel billet or bar to be coated is first subjected to a cleaning or preparatory bath to remove the scale and oxid from the surface or surfaces to be coated. After the preparatory bath, further oxidation of the metal is prevented by subjecting the surface or surfaces to be coated to an alkali solution preferably a chromate potassium or chromate sodium solution. Leaving this bath, the bar or billet is subjected to further treatment which consists in placing the

bar or billet in a solution of one of the salts of copper, or other suitable metallic salt. The particular salt employed is copper sulphate. The bar or billet is allowed to remain in this solution until a thin coating of metallic copper has been deposited on the bar or billet, after which the bar or billet is given a coating of brass, copper, or other desired metal. This coating may be either in the form of a solution or in powdered form and may be applied by a brush, spray, or by dipping. After being given the above preparatory treatment, the bar or billet is placed in a suitable mold preparatory to receiving the coating metal which is applied in molten form to the treated surface or surfaces of the bar or billet. Rolled shapes or tubing may also be coated in a like manner, which treatment may, if desired, be applied before the shape is given its pass through the finishing rolls.

936,378. October 12, 1909. CASTING MACHINE. Joseph Soss and Adolph W. Christianson, New York, N. Y.

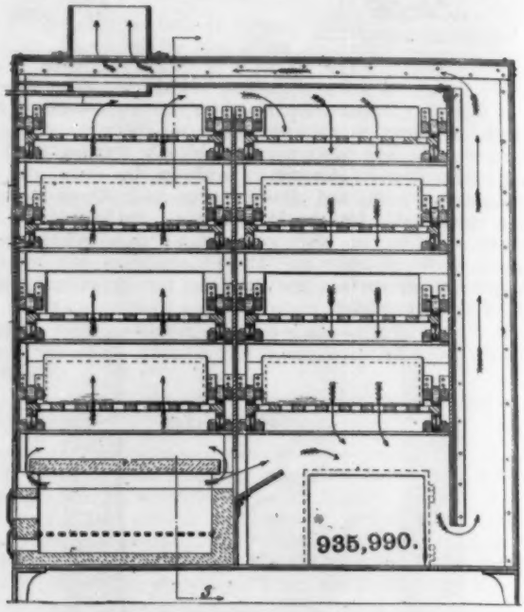
This invention relates to machines for casting small articles of various kinds and classes of metal, and the object is to provide an improved machine of this class which is simple in construction and efficient in operation, and which may be conveniently manipulated.



The machine shown in cut is particularly designed for casting various articles from soft metals which melt at a lower temperature than iron or steel. The metals of which the castings are to be made are placed in the retort receptacle and the burner is ignited. When the metal is melted it passes into a cylinder through an opening provided for it and is ready for the pressure to be applied. By the pressure exerted on the piston the metal is forced from the cylinder into the mold chamber and the casting is produced. The mold chamber is formed by two mold jaws which together make up the die and can be of any shape according to the article desired to be cast.

935,990. Oct. 5, 1909. CORE OVENS. Joseph J. Johnson, Newark, N. J.

This invention relates to ovens, and particularly to core ovens which are used for drying or baking cores used in molding. The object of the invention is to produce an oven of this class, shown in cut, which will be simple in construction, the temperature of which can be nicely regulated, and which will have a construction which will enable the oven to be kept constantly filled. More specifically the invention contemplates the use of a plurality of shelves which extend across the interior of the oven so as to support cores which are drying, and these shelves project at the sides of the oven so as to receive green cores which are to be dried or baked. When the cores on the interior are completely dried or baked, the shelves are advanced so that the green cores pass into the interior of the oven, while the baked cores pass out of the oven at the other side. In this way cores can be quickly removed without the loss of a substantial amount of heat, and the output of an oven of certain capacity is greatly increased. A further object of the invention is to construct the oven in such a way as to control the circulation of the gases of combustion, and to provide a more direct outlet for the gases, which is to be used to give an increased draft when the fire is being started.



926,863. July 6, 1909. ROLLING MILL. Jurom R. George, Worcester, Mass. Assignor to Morgan Construction Company, Worcester, Mass.

927,062. July 6, 1909. PROCESS OF MAKING COMPOUND METAL OBJECTS. John F. Monnot, New York. Assignor to Duplex Metals Company, New York.

927,372. July 6, 1909. CLAD METAL, by same inventor as 927,062.

927,916. July 13, 1909. PROCESS OF RECOVERING VOLATILE METALS AND METALLOIDS FROM LEAD AND COPPER SLAGS. Wilhelm Wieter, Hamburg, Germany.

929,518. July 27, 1909. PROCESS OF TREATING ALUMINUM SILICATE ORES. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company, New York.

932,678. Aug. 31, 1909. Can Lacquering or coating machine. Charles S. Bucklin, Baltimore, Md. Assignor to American Can Company, New York.

932,610. Aug. 31, 1909. CAN LACQUERING OR COATING MACHINE. John G. Hodgson, Maywood, Illinois. Assignor to American Can Company, New York.

933,944. Sept. 14, 1909. METHOD OF MAKING PURE UNCTUOUS GRAPHITE. Edward G. Acheson, Niagara Falls, Ontario, Canada.

932,834. Aug. 31. 1909. SHADE-HOLDER FOR ELECTROLIERS. Henry A. Torrey, Waterbury, Conn. Assignor to The Plume and Atwood Manufacturing Company, Waterbury, Conn.

933,749. Sept. 14, 1909. JEWELERS' PLIERS. Balfour Feagle, Longview, Texas.

935,564. Sept. 28, 1909. WIRE DRAWING MACHINE. Hugh L. Thompson, Waterbury, Conn.

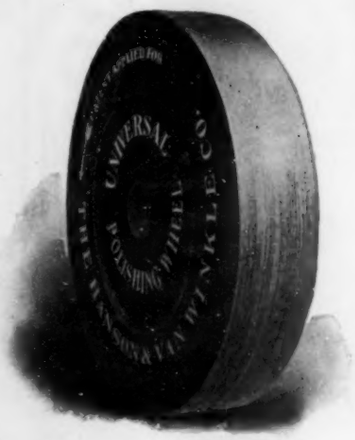
INDUSTRIAL

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

THE UNIVERSAL POLISHING WHEEL

By F. C. Eichstaldt.

At last a polishing wheel has been invented which when properly used, will do away with the use of the bull-neck leather and felt wheels. This is saying quite a good deal and the skeptic might say it is impossible, but the writer has seen the wheel in use and also wheels that have been in use for over two years, and was himself surprised at the amount of work one of these wheels could do. The wheel shown in cut is made up of the cheapest kind of sewed buffs. The sewed sections of buffs are given a treatment in a solution of glue especially prepared for this purpose, and it is this solution that is the secret of making the wheels. These sections are dried out and put together with this same glue of a thicker consistency, and put into a wheel press and allowed to stay there for some time and when properly made they will be as hard as a board, but when turned up



UNIVERSAL WHEEL.

and faced properly, they make a wheel which is unequalled for any kind of work except that which has to be kept perfectly flat and square. Such work cannot be done on any thing but a block or compass wheel.

Any work that has formerly been done on sewed buff or canvas wheels can be done to so much better advantage on one of these wheels and at the same time, one will not need any felt bull-neck or leather wheels to do the finishing operation on, as this wheel can be used for that purpose also. The writer has seen a factory in this city (and it is by no means a small one, it is without a doubt the largest stove factory in the world, The Michigan Stove Works) which uses nothing else for polishing except this wheel, and they have a pile of bull-neck and leather wheels piled up in a room, I should say a ton or more, that they have discontinued to use and thrown out, as they cannot compare with this new Universal Polishing Wheel. They also use them on their automatic polishing machines, and any one who knows the Garland stoves, knows that the finish on their nickel cannot be excelled by any other stove today. They use this wheel entirely for the principal reason that it saves them money in glue, emery, and capacity for work.

I herewith give in detail the correct method of taking care of this wheel; as the proper care of setting up or turning down of a wheel has everything to do with the amount of work that it will accomplish.

WHEN USED FOR ROUGHING.

For brass, steel or malleable iron, a medium soft wheel should be used. These wheels are made in three grades, soft, medium and hard. When the wheel is new it may be a little hard, but it will soften up when used for a few days. This may be aided by pounding it before and after using, just as is done with a canvas wheel or any of the soft sort of wheels. A flat piece of metal should be used so as not to dent up the face of the wheel. To set up when new, cut down face true with a file, stick or coarse sandpaper, while running. Then size it up with a thin coat of glue so as to lay the nap. Let it run a while and then use a piece of wet waste and a piece of pumice on the face while running, this will lay the nap and give you a fine smooth face on the wheel. Now take the wheel off and let it dry thoroughly and set up with two thin coats of emery, using number 120 emery for a number 80 wheel and number 140 emery for number 120 wheel for the first coat. After the wheel has been used and there is a body of emery on it, one coat is sufficient unless the work is very hard, in which case use two coats.

To clean off when it becomes necessary after the wheel has too much emery on it, use a large pipe or piece of broken casting, while the wheel is running to knock off the emery. When the emery has all been knocked off in this way, cut the face down with a buff stick or use a Universal Wheel Trimmer. If a flat smooth surface is desired, hold a piece of wet waste and a brick of pumice stone on the surface of the wheel while running. Let the wheel dry, then set up in the ordinary manner. A 12-in. wheel 2½ in. wide running at 1,760 to 1,900 r. p. m. will give best results on gray iron or malleable and brass. Keep roughing wheel open with a steel wire, flat back foundry hand brush.

WHEN USED FOR A FINEING WHEEL.

Use the wheel the same as for roughing, but use number 140 emery dry on iron and steel, and number 120 emery for brass with tallow, and buff the work right off. Use the same method for cleaning off the wheel as for roughing. If these wheels should get too soft, roll the face of the wheel in hot water and put it in a press, or lay an iron weight on it for a couple of hours, and this will harden it. The fineing wheel for steel and iron should not be cleaned off until it has too much emery on it.

OIL OR GREASE WHEEL.

If the work is cast iron, use number 140 emery, if steel or malleable use number 160. These wheels should be first used for fineing some work before using oil or tallow on them. A workman should have at least two of these wheels. After his day's work is done on a wheel, if it is still a good oil or finishing wheel, he then could wash off the wheel he had used the day before and keep the best one for a finishing wheel. The object of this is that he may have trouble with the glue on account of the weather, or his oil wheel may break out, then if he has the one of the day before on hand, he can still get out his day's work. To clean the oil wheel use pumice to cut all the grease off, then proceed as before, using no pipe or casting but warm water and a piece of waste with a piece of brick. Keep waste wet and hold the brick under the waste. The wet waste softens and loosens the glue and the brick cleans it off. This wheel should be cleaned thoroughly, let it run until dry and size up and set in the ordinary way (to keep this oil wheel cutting, keep open with brimstone and use tallow instead of oil). In cleaning the wheel I make use of the ordinary blower-hood and dripping pan, which is in general use. In order to make the working easier a few of these pans should be supplied.

One factory using these wheels for all their work has saved enough in glue and emery alone to keep them in wheels for six years. I am sure with that testimony in its favor, The Universal wheel will do the same for any one using it with the proper care as stated above.

The inventor of the wheel, Steve Cochell, with whom I am acquainted, has sold the process to the Hanson Van Winkle Co., of Newark, N. J., who are now prepared to fill orders for this wheel. It is a great saver of emery and glue for plow shares especially, and can be had in almost any size desired. I am sure that a trial of this wheel will convince the most skeptical of its merit. I am so much taken up with it myself, that I cannot say too much about it.

A PORTABLE ELECTRIC PYROMETER FOR QUICK READINGS OF HIGH TEMPERATURE.

The Wm. H. Bristol Electric Pyrometers have become well known in many processes where the temperatures lower than 2,000 degrees are used. These pyrometers have been made in both switchboard or portable form to indicate or record high temperatures, but most of the instruments now in service are for ranges of temperature lower than 2,000 degrees. A new quick reading form of the Wm. H. Bristol Pyrometers has been designed and preliminary models tested in actual service in several different processes where the temperatures are excessively high and the requirements very severe. This special pyrometer consists of a patented compound thermo-electric couple used in connection with a special portable instrument equipped with a pivot jewel bearing Weston movement. The complete outfit is shown in Fig. 1.

FIG. 1. QUICK-READING HIGH TEMPERATURE PYROMETER.

FIG. 2. SHOWING TIP-PROTECTED SHEATH.

The thermo-electric couple is shown externally in Fig. 2. Fig. 1 shows the couple with the protecting sheath pulled back against a stop leaving the tip of the thermo-couple exposed. When a reading is to be taken with this special thermo-couple it is inserted into the furnace or kiln as shown in Fig. 2 with the tip protected from mechanical injury and as soon as the couple has been inserted at the proper point in the kiln the iron pipe protecting sheath is slipped back so that the tip is exposed to the hot gases whose temperature is to be measured. After a reading has been taken the couple should be quickly withdrawn and partially cooled off before another reading is taken.

This form of couple is the invention of Professor Wm. H. Bristol, formerly of Stevens Institute and now president of The Bristol Company, Waterbury, Conn., which manufacture these pyrometers and recording gauges. The compound construction of this couple is shown in Fig. 3. The point "A" corresponds to the regular junction of an ordinary thermo-couple and the two elements which join at the point "A" are platinum and platinum-rhodium, this being the particular couple selected as a standard by the German Government. The platinum platinum-rhodium elements extend to the points B and C where they are welded to two other wires made of inexpensive alloys which are such that the electro-motive forces generated at B and C are practically equal and opposed when these junctions are both exposed to temperatures not higher than 1,200 degrees F. These inexpensive alloy elements are extended to the point "D" which is the cold end of the couple.

This construction of the quick-reading couple is such that the platinum-rhodium tip of the couple A may be exposed to excessively high temperatures up to 3,000 degrees F. without having the temperature of the junctions B and C exceed a safe limit. The temperature at A may be quickly measured with this special couple as the platinum-rhodium tip is exposed directly to the hot gases in the furnace or kiln. In this way an inexpensive substitute is provided for the expensive platinum-rhodium couples previously employed for the measurement of such high temperatures. The complete outfit is portable and readings of temperatures in the neighborhood of 2,500 degrees may be obtained in a very few seconds after inserting the tip of the couple to the point where the temperature is to be measured. By using a special form of the platinum platinum-rhodium tip this type of thermo-couple can be used to measure the temperature if red hot surfaces of metal or other material.

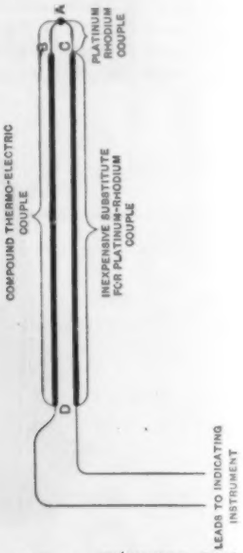


FIG. 3. SHOWING COMPOUND CONSTRUCTION.

CLEANING COMPOUNDS FOR METAL WORKERS.

By S. D. Benoliel.

Concerning the various cleaning compounds manufactured by the International Chemical Company, of Camden, N. J. The company claims to be the only concern in the United States that are just making a specialty of all the cleaning materials that are used for the cleaning of metal work before plating, tinning, galvanizing, japanning, lacquering, etc., for rough cleaning between machine operations, etc. They find that a great many concerns do not use the cleaner best adapted to the preparing of their work before these operations. Very often they do not even follow the best methods of handling their work independent of the cleaner used. The company do not claim to have any one cleaner that will do all classes of work satisfactorily, but they do claim, however, that they manufacture over thirty materials for the cleaning of metal work. The proper grade depending entirely on the particular conditions existing in any one factory. It is quite evident that where a concern has to clean articles, such as steel, cast iron, German silver, brass, etc., and the total output is not sufficient to justify them to use more than one cleaner, that the material to be recommended in this case, will be entirely different than where a concern manufactured goods made up of all the above metals in such large quantities that in order to improve their conditions it would be to their interest to use two or maybe three cleaners. Their

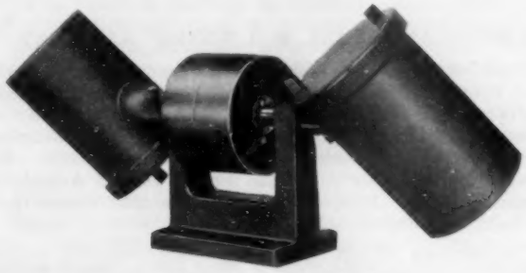
expert is always ready to go into details concerning the best methods of handling all classes of work and to make recommendations, not only as to the cleaners to be used, but as to the methods to be followed.

THE BLISS BENCH TUMBLING BARREL.

The tumbling barrel shown in cut is the outcome of many years' thought and experience trying to get a satisfactory machine that could be used on the bench for finishing, polishing, or cutting down work in the jewelry factories, and fills a long felt want.

It is claimed that by the use of steel balls with the machine, work can be polished and burnished far better and cheaper than by any other known method and that one of these machines used in any factory would soon demonstrate its usefulness and its money saving qualities.

The machine is built in three sizes: No. 1, 6 in. x 8 in., 2-inch pulley; No. 2, 8 in. x 12 in., 2½-inch pulley; No. 3, 10



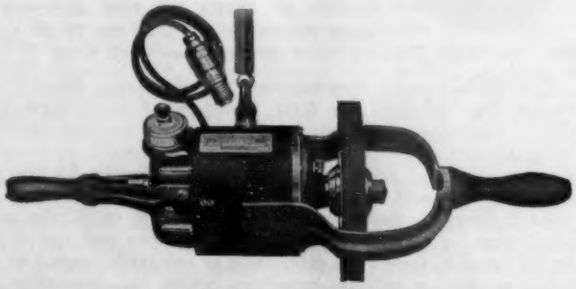
BENCH TUMBLING BARREL.

in. x 15 in., 3-inch pulley, of which the No. 1 is kept in stock ready for delivery. The other sizes are made to order, but several larger sizes will soon be made.

These machines are built by the E. C. Bliss Manufacturing Company, 91 Sabin street, Providence, R. I. Mr. E. C. Bliss, the designer of these barrels, has acquired considerable distinction in mechanical matters by his inventions and improvements in tools and machinery, largely along the line of jewelers' tools. He was recently elected president of the Providence Association of Mechancal Engineers. He is also a member of the American Society of Mechanical Engineers.

A PORTABLE ELECTRICALLY DRIVEN GRINDER.

The grinder which is herewith illustrated is a portable electrically driven grinder. It is used for grinding up cast iron castings, steel or any kind of metal which is to be ground. This grinder is being used in a number of machine shops for grinding metal castings instead of filing and chipping them and it is considered to do more work a day than two men can do by hand. It



PORTABLE GRINDER.

is portable and light in weight and is operated by attaching the attachment plug to an ordinary incandescent lamp socket. The bearings are cone bearings which are adjustable for wear and dust-proof. This grinder is made in four (4) different sizes, ¼ h.p., ½ h.p., 1 h.p. and 2 h.p. The grinder is manufactured by the United States Electrical Tool Company, Cincinnati, Ohio.

JOLT RAMMING MACHINE.

The Osborn Manufacturing Company, Cleveland, Ohio, are building a line of Plain Jolt Machines that is attracting a great deal of attention. The distinguishing feature of the Plain Jolt Machine is the variation of the length of stroke that may be obtained. This variable length of stroke is controlled by a traveling valve which is adapted to be set to give any stroke required from 3-16 of an inch to 1½ inches. The ability to change to different lengths of stroke will be found of great advantage in foundries moulding a variety of castings, and where there is a variation of the air pressure. This principle of a variable-controlled stroke was first shown in use on this company's Rockover Jolt Machine at the Cincinnati Convention of American Foundrymen & Manufacturers Supply Association. Their machines are designed to withstand hard usage and to work accurately. The cylinders are much larger in diameter than on other machines. This means greater stability and accuracy of stroke, and that each machine will be found to have a lifting capacity greatly in excess of its rating.

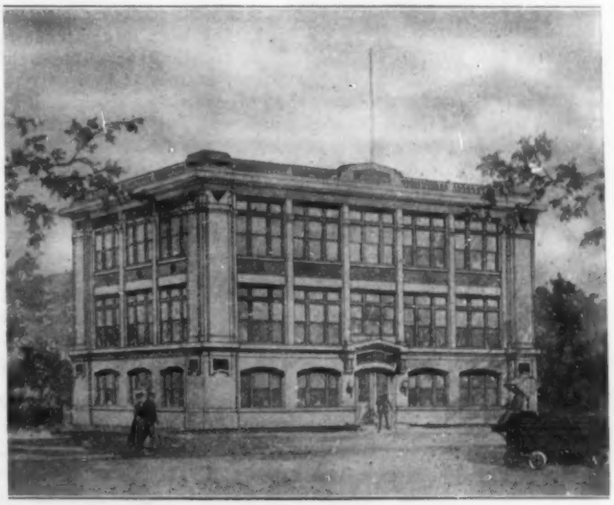
In spite of this greater lifting capacity, the Osborn Jolt consumes a smaller quantity of air per pound lifted than any other jolt machine on the market. This result is accomplished by the use of an ingenious blocking device in the air chamber.

These machines are made with lifting capacities of from 1,000 to 20,000 pounds.

NEW BUILDING FOR ELECTRO-PLATING SUPPLY FIRM.

The new office building for the Hanson & Van Winkle Company, manufacturers of electro-plating supplies, is located at 269 and 271 Oliver street, Newark, N. J., facing the East Side Park, and is constructed of reinforced concrete with decorative panels of Moravian tile and tapestry brick work. In size the building is 40 feet x 60 feet and three stories in height, the first for the private offices of the officials of the company, and the third as a general office. The heating plant and toilets are provided for in an extension from the main building in the rear.

The building, a cut of which is shown, is being built entirely of reinforced concrete, the exterior finish being the natural



HANSON & VAN WINKLE'S NEW OFFICES.

color of the cement; the interior is floated off to a sand finish with Portland cement and colored with waterproof cement stains, using a dark maroon for a dado five feet in height and cream color for the balance of the walls and ceilings. The floors are finished with cement applied directly upon and immediately following the installation of the concrete construction.

The roof, which is of re-inforced concrete construction, is protected with a felt and slag roofing, all flashings of sheet metal work throughout the building are of copper.

The building is constructed on the "American System" and is being erected by the American Concrete-Steel Co., Engineers and Contractors, Newark, N. J.

Associations and Societies

REPORTS OF THE PROCEEDINGS OF THE METAL TRADES ORGANIZATIONS.

INSTITUTE OF METALS.

President, Sir William White, K.C.B.; President-Elect, Sir Gerard Muntz, Bart.; Treasurer, Professor Turner; Secretary, G. Shaw Scott. All correspondence should be addressed to the Secretary, G. Shaw Scott, M. Sc., Institute of Metals, Caxton House, London, England. The objects of the Institute are for the educational welfare of the metal industry.

SIR GERARD MUNTZ, BART.

The Manchester meeting of the Institute was held Oct. 14 and 15, 1909, at the Hall of the Municipal School of Technology, Sacksville street, Manchester, England.

Dr. H. C. H. Carpenter, chairman of the reception committee, tendered the visiting members of the institute a hearty welcome. Councilor T. C. Abbot gave the members a civic welcome in the absence of the Lord Mayor. President William H. White responded to the addresses of welcome. He stated that he believed the record of the short life of the Institute of Metals was unparalleled in the history of any other technical society. Although having been in existence for 20 months, the membership now stands at 500.

The papers read and discussed at the meeting were included in the list published in the October number of THE METAL INDUSTRY. Two of these papers are published in this issue.

The election of officers for the ensuing year will be held at the annual meeting in London in January. The retiring president, Sir William White, K. C. B., will be succeeded by President-Elect Sir Gerard Muntz Bart. The other officers, with possibly a few exceptions, will be the same as at present.

THE PRESIDENT-ELECT.

Sir Gerard Albert Muntz, Bart., the president-elect, has special qualifications for the position. Still in the prime of life, he is possessed of boundless energy, and is actively engaged in metallurgical work.

He is the eldest son of the late Sir Philip Albert Muntz, M.P., and succeeded to the baronetcy on his father's death, which occurred on Dec. 21 of last year. He was born in 1864, and was educated at Harrow and subsequently at Victoria College, Nieuwied, Germany. His scientific studies were subsequently pursued at King's College, London, where he studied especially metallic modifications during his two years' residence. He joined the firm of Muntz's, Ltd., Smethwick, in 1883, and passed through every department of the establishment. He is just as well acquainted with the practical side as with the commercial and metallurgical sides, but his attention has for some time been concentrated on the last department. He has been managing director of the firm now known as Muntz's Metal Company, Ltd., since 1896.

Sir Gerard was one of the founders of the Institute of Metals, of which he has all along been an enthusiastic supporter. He has for years lived, moved, and had his being among non-ferrous metals. He was the creator of the firm's completely-equipped laboratory, and his office is a kind of world's inquiry bureau in regard to non-ferrous metals. Every day inquiries pour in from all parts of the world, from metallurgists and users of metals, who want some mystery solved as to metallic breakdowns, disappointments, and requirements. This is no small tribute, and while it involves endless labor, it constitutes a firm tribute to Sir Gerard's exceptional knowledge and experience.

The Muntz family is of Polish origin, and at one time they were members of the aristocracy of that country. Migrating to France, they were driven from thence by the French Revolution; and a member of the family, Peter Frederick Muntz, set up in Amsterdam as a merchant, and afterwards removed to Birmingham.

AMERICAN BRASS FOUNDERS' ASSOCIATION.

President, Wm. R. Webster, Bridgeport, Conn.; Secretary and Treasurer, W. M. Corse. All correspondence should be addressed to the Secretary, W. M. Corse, 1155 Sycamore street, Buffalo, N. Y. The objects of the Association are for the educational welfare of the metal industry. Annual convention with the American Foundrymen's Association in a succession of cities, as invited. The next convention will be held in Detroit, Mich., June, 1910.

The meeting of the Executive Committee, held recently in Detroit, was attended by W. R. Webster, president, Bridgeport, Conn.; W. M. Corse, secretary, Buffalo, N. Y.; Thomas Evans, Sr., vice-president, Philadelphia, Pa.; and L. W. Olson, vice-president, for Michigan, Ohio and Indiana, Mansfield, Ohio.

Official action was taken regarding the next convention, which was voted to be held in Detroit. Plans for the coming year were discussed and it was decided to make a special effort to gain new members in order to have sufficient funds to accomplish such ends as binding the transactions, etc. It was emphasized again about the advisability of getting as many metallurgists as possible from the various universities to affiliate with them.

NATIONAL ELECTROPLATERS' ASSOCIATION OF THE UNITED STATES AND CANADA.

President, Chas. H. Proctor, Arlington, N. J.; Treasurer, Nathan E. Emery, New York, N. Y.; Secretary pro tem., Percy S. Brown. All correspondence should be addressed to the Secretary, P. S. Brown, 906 Summit avenue, New York. The objects of the association are to promote the dissemination of knowledge concerning the art of electro-deposition of metals in all its branches. Meets the first Saturday of each month, 8 p. m., at the Hotel Chelsea, 222 West Twenty-third street, New York City.

The ninth regular meeting was held Saturday, November 6, at the Hotel Chelsea, 222 West Twenty-third street, New York City. There was a large attendance, twenty-eight members being present. The resignation of B. W. Gilchrist as secretary was received and accepted, with a vote of thanks for his past work for the society. The president, Chas. H. Proctor, appointed Percy S. Brown as secretary pro tem to fill the unexpired term. After considerable discussion pro and con it was finally voted to forbid the publication in any trade journal of any paper on plating subjects presented before the association unless sanctioned by a two-thirds vote of the members present. A committee of five was appointed to suggest a revision of the constitution. The banquet committee was instructed to make arrangements for a banquet to be held Saturday evening, January 15, 1910. Details will be sent to the members by mail. Two papers were read and samples of work shown relating to THE ACID COPPER-PLATING SOLUTION. Two active members were elected and the meeting adjourned.

TO THE PLATERS OF THE UNITED STATES AND CANADA AND THOSE INTERESTED IN THE ART OF ELECTRO DEPOSITION OF METALS OR ITS KINDRED BRANCHES.

A little more than six months ago the National Platers' Association of the United States and Canada was organized in the City of New York, as an educational and fraternal institution, whereby the platers of this great country and Canada could fraternize and meet each other on the common level, for the discussion and dissemination of knowledge and the interchange of thought and practical experience that would be to the common welfare of all of its members, present and future.

On October 1 the association was incorporated under the laws of the State of New York. The idea of its incorporation was due to the fact that its interests could be better advanced, and more safely guarded by being recognized as a corporate body, and would enable the association to grant charters of association to subordinate bodies or branch associations in other cities, where sufficient members could be obtained to maintain such an association. And through the parent association give them the proper protection consistent with the laws that governed its own incorporation. From the very conception of the organization its membership has steadily grown from many states, and the enthusiasm of its members has steadily increased until from the west and middle west we hear the echoes resounding for the formation of platers' associations in the large industrial cities where its recognized value is gaining ground every day, and many platers are anxious for their organization. Knowing this to be a fact, as president of the National Electro-Platers' Association I have instructed our worthy member, Mr. John D. Flanagan, of 255 Grand River avenue, Detroit, Mich., to make every effort to form the first branch of the National Association in the city of Detroit. I make an earnest appeal to all foremen platers and others interested in this movement to communicate with Mr. Flanagan, and by their united efforts endeavor to form such an association that eventually shall become an important factor in the welfare of the platers of the city of Detroit and vicinity.

Not only as regards Detroit do I make this earnest appeal for the formation of branch associations, but in the cities of Cincinnati, Chicago, St. Louis, or any of the industrial cities north, south, east or west of New York where sufficient membership can be obtained.

I am fully aware that more benefit can accrue to its members by the formation of branch associations in the cities distant from New York where monthly or semi-monthly meetings could be held, and matters discussed and appropriate papers read upon various topics, and by the interchange of such papers presented by members of the parent association, untold value will result to its members either as active or associate members.

Wherever it is found impossible to organize in sufficient numbers to maintain a branch association I would impress upon you the importance of joining the National Association in New York. By so doing you can reap the benefits that will accrue from the parent and branch associations through interchange of papers and the various topics introduced.

The association is based upon the highest ideals and with its educational and other features that are planned by its promoters and which will be fulfilled as rapidly as possible must prove of immense value to its members and prove a worthy addition to our great educational institutions.

As I have stated, the institution is purely educational and fraternal. The labor or commercial problems in any of its phases do not and cannot enter into any of its discussions as regards wages and the hours of labor; but it will make every effort to co-operate with state authorities for the betterment of the conditions in many plating establishments, that at present endanger the health of its members and the plating fraternity at large, owing to improper ventilation.

I invite you, Mr. Manufacturer, Superintendent, Chemist, Metallurgist or Representative of supply houses to become associate members with us, or any person who is interested in the electro-deposition of metals or its kindred branches. In union there is strength, and what cannot be accomplished by the individual can be accomplished by many.

Give your financial aid in this great work by becoming a member of the National or branch association. Pamphlets giving in brief the object and aim of the association can be obtained from the secretary, whose address is given at the top of this page.

CHAS. H. PROCTOR,
President of the National Electro-Platers' Association of the United States and Canada.

THE FOUNDRY AND MANUFACTURERS' SUPPLY ASSOCIATION.

President, F. N. Perkins, Freeport, Ill.; Treasurer, J. S. McCormick, Pittsburg, Pa.; Secretary, C. E. Hoyt, Chicago, Ill. All correspondence should be addressed to the Secretary, C. E. Hoyt, Lewis Institute, Chicago, Ill. The objects of the association are for the commercial and technical education of the iron and metal industry. Annual Exhibition and Convention with the American Foundrymen's Association, latter part of May each year in a succession of cities, as invited. The 1910 Exhibition will be held at Detroit, Mich.

The Executive Committee of the Foundry and Manufacturers' Supply Association held their annual meeting at the Cadillac Hotel, in Detroit, Oct. 12. The following members were present:

President, F. N. Perkins, J. S. McCormick, S. T. Johnston, John Hill, U. E. Kanavel, E. H. Mumford, E. A. Pridmore, J. S. Smith, Geo. R. Rayner, H. R. Atwater, T. S. Hammond, and C. E. Hoyt.

At 10 a. m. the committee met with a committee from the Local Foundrymen's Association. This joint meeting was called to order by Dr. F. T. Stephenson, chairman of the Local Committee, who addressed the members, laying before them the plans that the Local Committee had made for handling the 1910 convention of the allied associations, suggesting the week of May 30 as being the most desirable time, and the Michigan State Fair Grounds as the best place for holding all association meetings and the exhibit of the Foundry and Manufacturers' Supply Association, stating that the large buildings that were available and the splendid opportunities for erecting temporary buildings, the railroad sidings and unloading platforms, together with the beautiful grounds and good street car service, this would make an ideal location for this convention.

AUDITOR'S REPORT.

The report of the International Audit Company, of Chicago, which had audited the books of the secretary, was then read, and it was ordered that this report be made a part of the secretary's report, and printed for members, showing the financial standing of the association.

DIVIDEND.

The secretary stated that when the committee met in Cincinnati in February, 1908, it was called to their attention that there had been a deficit following previous conventions, and with this in mind, the committee wisely provided against re-occurrence of such conditions by curtailing certain expenses and increasing the space charges for exhibitors, that all expenses of the association might be met and a small sinking fund established. They further provided that in the event of there being a surplus after all expenses of the year had been provided for, such amount as was in excess of $1,500 should be declared in the way of a dividend pro-rata to space users, such dividend to be declared by the Executive Committee at the annual meeting.

After hearing the financial statement, it was ordered by the committee that $1,500 be set aside as a sinking fund and that a 30 per cent. dividend be declared and paid to those who had paid for space at the last exhibit. The committee then took up the question of the 1910 meeting, as this matter had been referred to them by the association at the annual meeting, with power to act. President F. N. Perkins was instructed to accept the invitation of the Detroit Foundrymen's Association to meet there in 1910, on terms to be arranged to the mutual satisfaction of both associations.

President Perkins announced that he had received the resignation of Mr. J. H. Whiting as a member of the executive committee, and appointed T. S. Hammond, of the Whiting Foundry and Equipment Company, to fill the vacancy caused by Mr. Whiting's resignation.

ITEMS OF INTEREST TO THE INDIVIDUAL.

Ferdinand Deming, the rolling mill master mechanic, has gone to New Toronto, Ontario, Can., to help start the Ontario Brass Rolling Mills.

Peter Discho, the well known galvano-plastic plater has accepted a position as foreman plater with the Tube Bending Machine Company, of Glen Ridge, N. J.

William A. Beveridge has been engaged as foreman of the foundry by the Bridgeport Deoxidized Bronze Company, manufacturers of all kinds of non-ferrous metals, in ingot or manufactured form, of Bridgeport, Conn.

Hugh McPhee, formerly foreman of the Edna Smelting and Refining Company, Cincinnati, Ohio, has become foreman in charge of the brass and aluminum foundry of The Maxwell Briscoe Moter Company, of Tarrytown, N. Y.

Benjamin W. Gilchrist, secretary of the National Electroplaters' Association of the United States and Canada, has taken charge of the plating and finishing department of the Kelly & Jones Company, manufacturers of plumbers' supplies, at Greensburg, Pa.

E. R. Holly, formerly superintendent of The Bristol Brass Company, Bristol, Conn., has become superintendent of the Arlington Stamping Company, manufacturers of lamp burners and various articles of sheet brass, at Arlington, N. J. This company is contemplating an increase of their capital stock, and consequently an enlargement of their plant.

Chas. J. Caley has now severed all of his connections with the Russell & Erwin Manufacturing Company, of New Britain, Conn., with which company he was general manager and stockholder, but had to give up his position on account of ill-health. Mr. Caley has now recovered completely and is making a Western trip. In the future he will take up some line of manufacturing and may be connected with the Hoet & Cooley Company, of New Britain, though no official notification is as yet ready for publication.

DEATHS

Frank Davol died Oct. 28, 1909. Mr. Davol was a member of the late firm of John Davol & Sons, metal dealers of John street, New York, and a member of the New York Metal Exchange since 1885.

L. A. Crandall, the manager of the Western branch of the J. W. Paxson Company, Toledo, Ohio, died at his home in that city Oct. 17 after a short illness.

Mr. Crandall was the inventor of the Crandall cupola, now in quite extensive use. He was also one of the organizers of The Detroit Foundry Supply Company, of Detroit, Mich., in which he was interested, and was vice-president for several years. Mr. Crandall was born in 1850 and was a foundryman of long experience.

Pierce N. Welch, of New Haven, Conn., who for many years was identified with the different branches of the metal industry died suddenly in Berlin, Germany, Oct. 26, age sixty-eight years. At the time of his death he was president of the Bristol Brass Company, and vice-president of the Bristol Manufacturing Company, both of Bristol, Conn., and a director of the New Haven Clock Company, New Haven, Conn. Besides his interest in business affairs Mr. Welch has contributed to Yale College and philanthropic enterprises. He leaves a widow, four daughters and one son, Pierce Noble Welch, Jr., who is treasurer of Peck Bros. & Company, New Haven, Conn.

EDWARD T. COE.

E. T. COE.

At a meeting of the board of directors of the American Brass Company held in the City of New York, October 20, 1909, the following preamble and resolutions were unanimously adopted:—

Whereas, Edward Turner Coe, a member of this board, died at his home in New Haven, on the 5th day of October, 1909, and

Whereas, this board desires to inscribe upon its records a fitting tribute to his memory, be it

Resolved, That with feelings of profound sadness we realize in the death of our esteemed associate, that the last representative of an honored name, which has been prominently identified with the brass and copper industry in America since its beginning, has passed away.

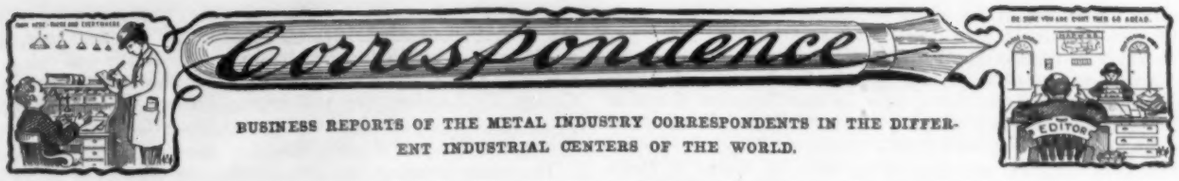
True to his ancestry, Mr. Coe devoted his entire business life to the interests of the corporation which bore his family name, becoming at a comparatively early age its treasurer, and continuing in that office until failing health compelled his retirement. His unquestioned integrity, quiet and unassuming manner, kindness of heart, and loyalty to his friends, inspired respect and affection. The high regard in which he was held by his fellow citizens in town and state was evinced by his election at different times to both houses of the legislature, where he acquitted himself with honor and credit, and among those who will sincerely mourn his loss are the citizens of the town in which the greater portion of his life was spent, and the employees of the factory with which he was so long connected.

As a member of this board, he brought to its councils a practical knowledge, based upon long experience, and while by nature conservative, he always favored whatever tended to substantial progress and development. His many admirable qualities endeared him to us all, and it is with deep sorrow that we contemplate his loss. To his bereaved wife and family we tender our most sincere sympathy.

Resolved, That the foregoing resolution be entered upon the minutes of this meeting, and a copy thereof sent to the family of the deceased.

EDMUND HENDRICKS.

Edmund Hendricks, senior member of the firm of Hendricks Brothers, died on Oct. 2 at his residence in New York, aged seventy-five years. For over half a century Mr. Hendricks had been connected with the well known copper manufacturers and dealers of Hendricks Brothers, he being one of the fourth generation who are descendents of Uriah H. Hendricks who established the business in 1764. Besides his active business connection with the firm, Mr. Hendricks was for many years a prominent member of the New York Metal Exchange and influential on the Exchange board of managers. He was a veteran of the Civil War and of the Seventh Regiment N. G. S., N. Y., and a member of the Lafayette Post G. A. R. He is survived by two brothers, Francis and Harmon W. Hendricks. There will be no change in the personnel or policy of the firm of Hendricks Brothers from his death.



BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS IN THE DIFFERENT INDUSTRIAL CENTERS OF THE WORLD.

WATERBURY, CONN.

NOVEMBER 3 1909.

In the great metal factories here the tide of prosperity seems nearly full and with overtime in nearly every large plant in the Naugatuck Valley, made necessary by the continued and insistent demand for brass and copper products, there is a prospect that all records will be broken in the holiday season. Generally at the approach of the holidays work slackens and conditions become normal, with little or no overtime, but it is not unlikely that there will be a general rush compelling full speed and extra help in nearly every shop throughout the coming season. With copper prices still low and the stock of raw material demanding constant renewals, the rush has affected the railroad and there is more work in its freight houses here now than in those of any other city in Connecticut. Receipts here are now quite as satisfactory as during the prosperous months of 1906 and there is apparently no likelihood of an immediate slump. Within the past month upwards of 3,500 cars a week have been loaded and sent out of the Waterbury yards with the products of the metal goods' factories.

Everything is not serene with the manufacturers, however. The long dry spell has left the factories in a bad way through the shortage of water and every conceivable means is being resorted to by the large concerns, which depend partly on ponds and rivers near their plants, to make every drop count. Streams far out into the country have been dammed and their contents piped to the factories to fill the troughs usually supplied with water from some of the rivers or canals running near. The Naugatuck River itself is not as deep as a trout brook and from Seymour to Winsted every factory drawing on it or its tributaries has been hard up against the water supply problem. The city reservoirs are so low that it is not easy to supply the drinking water of the citizens here and every manufacturer is anxious to see rushed along the work recently begun on the big dam at Thomaston, just back of Wigwam reservoir. When the problem of water supply, so serious here, on account of the unexpectedly rapid growth of the city and its industries, which necessarily consume enormous quantities, is settled, every manufacturer will breathe more freely.

Splendidly equipped with springs and ponds by nature this valley seemed to promise endless supplies of water a few years ago, but with the rapid consumption of young trees, for manufacturing purposes chiefly, the forests have disappeared or become too emaciated to be of much value in the conservation of the bounteous resources of nature. Here is a striking lesson of the need of better laws for forest conservation.

The Scovill Manufacturing Company, especially, has been hard pressed for water, but has kept all departments running and scores of extra hands busy. This great plant is none too large, although considerably increased in capacity during the past year for the present demands upon it and a moment's reflection over its present rush, in view of the great volume of business done by the American Brass Company, leads to the conclusion that the prosperous conditions here are the result of like conditions in many other parts of the world—for Waterbury's products are to be found everywhere.

The Chase Rolling Mill Company continues to hold second place among the shippers here, the American Brass Company leading and the Scovill Company next in line. The other Chase concern, the Waterbury Manufacturing Company, is very busy and has large gangs at work from six to ten hours a week overtime, with full night and day shifts in some departments. The Benedict and Burnham Company is running overtime. The American Brass Company is busy in practically every department and shop throughout the Naugatuck Valley, and particularly in its shops here, and is running day and night in several departments. It has been filling extensive orders for shops in other parts of the State and its freight shipments out of Waterbury are heavier now than at any time in the past five years.

The watch shops, the Waterbury Clock Company, the New England Watch Company and the new Bannatyne shop are all busy completing their holiday orders, and in the clock department and the Waterbury Clock Company, there has been a remarkable increase in business since September. All the wire mills are busy and the novelty manufacturers are kept on the alert to keep orders filled.

Concerns like the Waterbury Buckle Company, the Waterbury Button Company, the Novelty Manufacturing Company and others, where are made various small notions and patented articles, buttons, buckles, and so on from brass, copper, silver, nickel and other metals and the so-called "novelties" from fancy rolled metals are running until nine and ten o'clock at night and their orders are constantly increasing, not only from all over the United States, but from foreign countries.

The machinery manufacturers, too, are experiencing a very gratifying business.

The smaller shops are greatly benefited by this rush and all are running along merrily filling their own orders and picking up parts of orders from the larger concerns.

In a previous report in this column the prospects of the 1910 automobile business was reported. These expectations are more than realized and the Noera Manufacturing Company, the Novelty Manufacturing Company, Scovill's, and the other plants manufacturing parts or attachments for autos are still receiving orders for prompt delivery from concerns all over the country engaged in the manufacture of horseless vehicles.

One of the characteristics of this city's industrial development is called to mind in this connection. There are no automobile factories here, although it is possible to have every known part of a machine made in Waterbury. This also calls to mind the wide scope of the Brass City's productive facilities, for right here are made the principal and minor parts of some of the most common machines and tools, for the production of which other cities and towns are given the credit. In the past few years, for instance, one of the most important additions to the metal industry has been the development of safety razors. Parts of nearly all the best known "scrapers" are now manufactured here by the Waterbury Manufacturing Company, the Scovill Company, and some of the smaller concerns, while one of the largest safety razor firms has for many months had a large portion of its invention made entirely in this city, its Boston factory not being able to produce sufficient stock. Waterbury manufacturers prefer rather to make the goods for the world at large and are not jealous of the towns getting the reputation of making them.

Business with the foreign markets is picking up gradually and collections have improved since Oct. 1. F. B. F.

PROVIDENCE, R. I.

NOVEMBER 4, 1909.

An analysis of the state of business in the manufacturing jewelry establishments of the Providence district shows a healthy volume of trade. The majority of the manufacturers report a condition that is about normal for this time of year. The conditions which indicated a few months ago that this season might be a phenomenal one did not persist and there has been somewhat of a slump in some lines. The silver novelty trade is one of those which has felt this slump. The designers and pattern-makers are not at work getting out the new spring patterns.

Clarence M. Dunbar, treasurer of the Cook, Dunbar, Smith Company, manufacturing jewelers, has been re-elected commodore of the Rhode Island Yacht Club. The commodore's yacht,

"Artmar," was one of the most popular vessels in the Rhode Island fleet last season.

A verdict of $28,060 has been awarded the Cornell-Andrews Smelting Company, of Attleboro, against the Boston and Providence Railroad Company by a jury in the Superior Court at Fall River. The smelting company claimed that its premises had been damaged by the abolition of a grade crossing.

Herbert A. Capron, secretary of the firm of Brown & Dean, gold and silver refiners, of this city, died of a complication of diseases recently at his home in Pawtuxet Neck. For several months he had beeen ailing and recently was confined to his bed. He was also prominent in automobile circles, being president and treasurer of the Rhode Island Motor Car Company.

Ernest L. Upham has resigned as general secretary of the Y. M. C. A. at North Attleboro and has taken a position with the jewelry firm of Cheever, Tweedy & Company.

A complimentary dinner was tendered to Henry G. Thresher by the manufacturing jewelers of the city on Saturday evening, October 16, at the West Side Club. Mr. Thresher was chairman of the jewelers' tariff committee and the dinner was tendered as a mark of the manufacturers' appreciation of his efforts in their behalf. One of the most pleasing features of the evening was the presentation to Mr. Thresher of a magnificent silver loving cup. The presentation address was made by George H. Holmes.

Resolutions of thanks were adopted Saturday evening, October 31, at the annual corporation meeting of the New England Manufacturing Jewelers' and Silversmiths' Association to Senator Nelson W. Aldrich and Representative Sereno E. Payne for their efforts in securing a beneficial paragraph relative to jewelry and silverware in the new tariff bill. A resolution thanking Congressman Adin B. Capron, of this state, for the part he played in the same effort was also adopted. The meeting, which was held in Freemason's Hall, was preceded by a reception at 6 o'clock. Half an hour later more than 200 members of the association proceeded to the dining-room, where the annual dinner was served. At the conclusion of the dinner President Harry Cutler called the business meeting to order.

The report of Everett L. Spencer as secretary showed the membership of the organization to be 336, while the report of Treasurer Harry M. Mays showed the finances to be in a flourishing condition. George H. Holmes, chairman of the advisory council, presented an interesting report of the work accomplished during the year. Alfred K. Potter presented the report of the association's free labor bureau.

A lengthy and detailed report on the provisions of the new tariff law as applicable to the jewelry industry was made by Henry G. Thresher, chairman of the revision committee. President Cutler then presented an exhaustive report showing the progress made by the association along special lines in improving and benefiting the manufacturing jewelry industry.

On recommendation of the nominating committee the following officers were unanimously elected: President, George H. Holmes, Providence; vice-presidents, Theodore W. Foster of Providence, Harold E. Sweet of Attleboro and Charles T. Paye of North Attleboro; secretary, Frederick A. Ballou, Providence; treasurer, Wade W. Williams, Providence; directors, William P. Chapin, Frank B. Reynolds, Harry M. Mays, Arthur O. Ostby, Alfred K. Potter and Edward B. Hough of Providence, T. S. Carpenter, R. C. Thompson of Attleboro, and Walter S. Ballou of North Attleboro.

The new president introduced as the speaker of the evening Frederick R. Boocock of New York, who made an interesting address. He was followed by John F. P. Lawton of the Gorham Manufacturing Company.

President Holmes announced the following committees for the year: Auditing, Ralph S. Hamilton and George H. Cahoone; press, Frank T. Pearce and John M. Buffington; advisory council, Theodore W. Foster, Harold E. Sweet, Charles T. Paye, Wade W. Williams, Frederick A. Ballou, Alfred K. Potter, William P. Chapin, Thomas S. Carpenter, Arthur O. Ostby, Frank B. Reynolds, Harry M. Mays, R. C. Thompson, Walter S. Ballou, Edward B. Hough, George K. Webster, Everett L. Spencer, Albert A. Bushee, Charles E. Hancock, George H. Cahoone, Roswell C. Smith, Clarence M. Dunbar, Ralph S. Hamilton, Everett I. Rogers, William A. Schofield, Harry Wolcott, J. Solinger, Howard H. Wilkinson, Fred B. Kennion, T. G. Frothingham, William T. Chase and Ernest M. Bliss.

Willard U. Lansing, for the past thirty years connected with the S. & B. Lederer Company, of which he was secretary, died at his home here Wednesday, November 3. Death was due to an attack of acute Bright's disease. Mr. Lansing was a brother of George D. Lansing, the well-known lumber dealer, and many years ago was in the lumber business himself. He was born in Watervliet, N. Y., July 30, 1841.

The manufacturing jewelers of the city played an important part in the elections held here Tuesday, November 2. Henry Fletcher, treasurer of Fletcher, Burrows Company, was re-elected Mayor of Providence on the Republican ticket by an increased plurality. He made his fight on the platform of a business administration for the city. One of his opponents was John W. Higgins, a jewelry worker, who was the candidate of the Socialist party. Alderman John Kelso, a jeweler of the Second Ward, was re-elected by a substantial plurality. John J. Louth, a silversmith, candidate for Alderman on the Democratic ticket, was defeated.

Among the successful candidates for the City Council were William A. Schofield, of Schofield, Battey & Co.; Joseph P. Doyle, a silversmith; Lawrence Canning, a jewelry operative, and John Fallon, a jeweler. Among the unsuccessful candidates were William J. Feeley, treasurer of the W. J. Feeley Company; John J. O'Neil; Albert E. Stevens, secretary of the United Wire and Supply Company; Joseph Baker, Jr., a foreman at the Gorham plant; E. Merle Bixby, superintendent of the silver department of the Shepard Company, and Aldridge G. Pearce, superintendent of the F. T. Pearce Company.

Harry Cutler, of the Cutler Jewelry Company, was re-elected as a member of the House of Representatives by a flattering plurality. George H. Holmes, the new president of the New England Manufacturing Jewelers' and Silversmiths' Association, and treasurer of the George H. Holmes Company, was also re-elected by a substantial vote. Edgar A. Mowry, treasurer of the George L. Vose Manufacturing Company, made his debut into politics by being elected a member of the House.

BUFFALO, N. Y.

NOVEMBER 3, 1909.

The manufacturing and wholesale end of the trade in this city was all activity last month and the receipts for the year now drawing to a close will show a big gain over the two preceding years, according to heads of local houses. Early in the summer there was a steady gain in business that has continued on a healthy basis and dealers are optimistic over the prospects.

Brass founders here received many orders for special work last month; most of them have enough advance orders to keep them busy the current month at least. There is much copper and brass specialties turned out for the local trade, probably owing to the renewed building activity. This is also helping the plumbers' supply houses.

The Riverview Metal and Bronze Company has filed plans for the building of two one-story frame and iron factories at No. 18-19 Gull street, to cost $3,000.

The second annual Buffalo Industrial Exposition, held last month at the Broadway arsenal under the auspices of the Manufacturers' Club, was the most successful show of local-made products ever held in this city.

The firms in our lines with exhibits were the Aluminum Castings Company, aluminum, brass and bronze castings; Buffalo Copper and Brass Rolling Mill, and Robson Smelting Company, anti-friction metal, etc. All the exhibitors expressed themselves pleased with the results, but appeared disappointed that more metal firms had not secured space.

The plan is to build a permanent exhibition building that can accommodate more manufacturers who desire to come in, and next year's show may see it realized.

The automobile business, which is no small factor in the local brass and aluminum trade, is booming, and jobbers are feeling the benefits.

Manufacturing jewelers are busy turning out rings and other articles for the holiday trade. Their orders from the trade were larger than last year at this time. One concern here that does $1,000,000 worth of business a year has recently enlarged its plant and expects to increase its output.—F. M. A.

DETROIT, MICH.

NOVEMBER 3, 1909.

During the past six months Detroit has been experiencing a boom in business in every line of trade, and especially in the aluminum and the brass industries, which have reached enormous proportions. Factories and manufacturing plants of all kinds are running to their greatest capacity, and the demand for men is greater that the supply. This applies particularly to the brass industry and the manufacture of automobiles, for in Detroit these two lines of industry are closely allied.

Secretary Whirl, of the Employers' Association, makes an unusually encouraging report for the month of October. There is no other man that is closer to the metal trades industry in Detroit than he, and with no attempt of exaggeration, he declared that Detroit is experiencing the greatest boom in the history of the metal trades that the city has ever known. He accounts for this along ideas peculiar of his own, but they are vouched for by every manufacturer and business man in the city.

"Years ago," declared Mr. Whirl, "Detroit business men adopted a policy of putting nothing on the market that would not bear the closest inspection. The highest class of goods is the only thing that they will turn out. They carried the idea to the extreme and at one time it was thought that the rules were too severe, and that the bars might be let down a little. But the stringent rules were carried out and the value of high class goods has resulted in placing Detroit way above all other cities in regard to the metal industries. The best brass and aluminum goods to be found in the world are manufactured here. The bulk of the brass goods demanded by the automobile manufacturing establishments is manufactured here. It was simply because Detroit manufacturers did good work that the automobile industry has grown to such enormous proportions in this city. And because the automobile industry has grown so rapidly is the reason that the city has become the leading brass and aluminum center of the country."

The Sherwood Brass Works are among the leading industries of the city that give an enthusiastic report of business for the past month and shows prospects of a continual boom throughout the winter. This concern, while it manufactures a large amount of brass automobile parts, engages heavily in the aluminum business. The plant is running to its fullest capacity, and even at that finds it difficult to keep up with orders.

The Aluminum Casting Company has also enjoyed a profitable trade during the past month and enters November with prospects of a rush throughout the winter. The successful condition of this firm is due to the fine articles manufactured and the demand for them by the automobile plants throughout the city. Sixteen great plants of this kind are daily turning out a vast number of machines that are heavily trimmed with brass and aluminum. Only a few of the brass parts used are manufactured by the automobile concerns themselves. So heavy is the demand for brass and aluminum that many firms in the East and the Middle West are aiding in meeting the demand, as it cannot all be met in Detroit.

The manufacturing jewelers also report a vigorous business for the month just closed. Wright, Kay & Company and Traub Bros. report a good business and are already getting in trim for the coming holiday trade. They have every reason to expect a large demand from every part of the West. Times are good, and this condition of course makes it easy for jobbers and retailers to buy heavily.—F. J. N.

CLEVELAND, OHIO.

NOVEMBER 5, 1909.

The feature of the month in Cleveland is the extraordinary busy condition in which the metal industry finds itself. The automobile factories are being rushed to capacity and are turning out more parts than ever before in their history. A number of the auto factories here, of which there are nine large ones, are preparing to add to their brass molding and nickel plating departments during the coming winter, to be ready for the great demand which is expected to materialize next year.

The aluminum factories here report an ever increasing call for aluminum castings of all kinds. It is being used more extensively than ever in many lines of work. Glenn Curtiss, the famous aeroplane operator gets his aluminum castings for his air ship engines from the United States Bronze Co. of this city. During the past month Curtiss stopped off for a day in Cleveland for the purpose of looking over the factory of the company and to confer with its officers concerning some delicate castings which he is having made here.

Building operations continue active among various metal manufacturing concerns. The latest to announce improvements is the National Bronze & Aluminum Co. which is making a good sized addition to its plant at 2538 E. Seventy-ninth street. The Ferry Cap & Set Screw Co., which makes set screws of brass, is also making an extensive addition to its plant on Scranton Road.

Manufacturers of plumbing fixtures here report an unusually keen demand for brass and nickel plated goods and are working their plants to capacity. Hundreds of structures are being built in the Middle West and the increased use of sanitary plumbing calls for greater use of brass and other metals.

The H. & H. Art Metal Co., which has been located on Prospect avenue near E. Second street, and engaged in the manufacture of various kinds of art metal goods has leased a large factory which was formerly a part of the plant of the White Automobile Co. on Canal Road. The company is moving to its new quarters where it will greatly enlarge its present business. The building acquired is about 50 by 130 feet in size and four stories high.

Interest in art metal work for interior household decoration as well as fine art jewelry was stimulated during the past month by the display of several cases of each at the show of the Cleveland Architectural Club in the Rose Building, lamps, sconces, domes and chandeliers of beaten copper and brass were on view and greatly admired while the showing of cleverly executed jewelry attracted general attention.

The Webb C. Ball Watch Co. expects to move to its new quarters in the Kindmore building, Euclid avenue near E. Twelfth street within a short time. A four story addition for the use of the company has been about completed. The Webb C. Ball Jewelry Co. will also move to a large store in the same building facing on Euclid avenue.

A record breaking trade is promised here this Christmas for metal novelties, and popular jewelry. The call which is being made for aluminum cooking utensils for use as presents is astonishing, many of the dealers are laying in heavy stocks in anticipation of a big line of business.—S. L. M.

BIRMINGHAM.

The shareholders of the Mint, Birmingham, had an unusual experience at their recent meeting in discovering a profit on the year of only £1,743. This company during the past twenty years has made a total profit of £314,000, being an average yearly profit of £15,000. Further figures adduced by the chairman showed that £10 8s. 6d. had been returned in dividends for each original £5 share. This is a fairly good record, which prevented the shareholders grumbling, and they again receive their 10% through the addition of £5,000 from the reserve fund. The dullness, as the chairman pointed out, was due to the absence of orders from abroad for minting, and the directors could not convince the nation that they wanted more money. At the same time raw material had gone up, while the price of the manufactured article had gone down. With regard to the future, the prospects were not rosy, though an improvement might come at any moment.

The shareholders of Allen Everitt & Sons had an unpleasant experience at the meeting in Birmingham on June 15, when they were deprived of their ordinary dividend, owing to the fact that of the £14,919 profit made on the year, £9,000 had disappeared as the result of the adoption of a smelting process intended to reduce the metallic loss in the working of metals. The chairman explained that this was the first time in their history anything of the kind had happened, and it was due to the department failing to test or insufficiently testing their operations. The gentleman charged with that department had retired and the successor would be appointed shortly. It was explained that the firm have a splendid order book, and their copper had been well bought.—J. H.

TRADE NEWS

TRADE NEWS OF INTEREST DESIRED FROM ALL OF OUR READERS. ADDRESS THE METAL INDUSTRY, 61 BEEKMAN STREET, NEW YORK.

The Atlas Machine Company, of Waterbury, Conn., are now working until 9 o'clock every night to take care of their general machine work for customers.

G. B. Esterly, 130 Mott street, New Bedford, Mass., is about to start in the plating business and would like to correspond with the manufacturers of plating supplies.

The New Britain Company, of New Britain, Conn., manufacturers of engines and specialties, has planned an addition to its plant of a four story brick structure, 26 by 87 feet. The estimated cost is $10,000.

The Robert Stock Manufacturing Company, of Buffalo, N. Y., have moved from 221 Franklin street to larger quarters at 430 Niagara street, where they expect to install an electro-galvanizing plant for galvanizing malleable iron castings.

The Bradford Foundry Company, Limited, of Bradford, Pa., manufacturers of brass, bronze, aluminum and iron castings, have succeeded to the foundry busines of the G. W. Fleming Company, of the same city.

The Metal Dross Economy Company, of Bristol, Conn., report that they have equipped recently with their skimming tanks the rolling mills at Rome, N. Y., and also the factory of the Yale and Towne Manufacturing Company, at Stamford, Conn.

The Weber Manufacturing Company, of Jamestown, N. Y., manufacturers of brass goods, has purchased the business of the Eberman-Bailey brass foundry on Institute street, in that city, and will operate it in the future, in connection with its own business.

The Bridgeport Brass Company, Bridgeport, Conn., expect to have their new tube mill in operation about January 1 and their new manufacturing building will be completed shortly after that. They report business good and the prospects for the coming year very bright.

The Lumen Bearing Company, of Buffalo, N. Y., manufacturers of brass, bronze and aluminum castings, have started the construction of a brick and steel foundry building as an addition to their present plant at Sycamore street and the New York Central R. R. tracks.

George G. Prentice & Company, Inc., New Haven, Conn., report that they are sold ahead on their automatic turret lathe until July, 1910. They are now running 21 hours a day and say that during the dull business period of last year they were operating their factory on full time.

William Winch, 398 Washington street, Taunton, Mass., formerly employed by Reed and Barton of that city, will start a first class electro-plating works at Brockton, Mass., where he will be prepared to submit bids for all kinds of job plating in nickel, silver, gold and brass plating.

The additions to their plant which the Waterbury Rolling Mill Company, Waterbury, Conn., completed not long ago are now in regular use and the mill is being operated to its full capacity. The company reports many orders on hand and in view, especially for their German silver products.

During the month of October a number of the manufacturers of metal goods, or as they are known "cutting up shopmen," went to New York and had a lunch and a talk over business conditions. The different firms represented comprised the leading metal goods manufacturers of Waterbury, Conn.

The Genesee Metal Company, of Rochester, N. Y., report that business is improving every day with them and the outlook for the future is very promising. They have booked several large contracts, which practically takes care of their entire output on certain lines. They report that their ingot business is thriving.

The Cullen-Atkinson Company, 120 Allyn Street, Hartford, Conn., have recently received numerous orders from brass founders and manufacturers for their ovens for core-baking, japanning, etc. This firm makes a revolving core oven operated by a small electric motor, which they state has been very successful.

Owing to increasing business the Jonathan Bartley Crucible Company, Trenton, N. J., are going to build another new kiln and also an extension to their present manufacturing building. The extension will be 75 x 100 ft., four stories, brick and steel. Mr. Bartley reports a very good business outlook for crucible manufacturers.

The Pequonnock Foundry, of Bridgeport, Conn., have started the work on their new foundry building on Fifth street. The structure will be 75 x 120 ft., of brick and steel, one story high, with gravel roof. The building will be ready for occupancy Jan. 1, 1910. A specialty will be made of automobile and marine motor castings.

The tube mill of The Hawkins Company, at South Britain, Conn., has been closed pending the settlement of a difference of opinion between the parties interested. Up to the time of the shutting down of the mill, there had been drawn 20,000 pounds of brass tubing. No announcement has been made when the mill will start again.

The J. H. Matthews & Co., 306 Wood street, Pittsburg, Pa., manufacturers of high grade signs, have prepared a most elaborate front for their store, which consists of tablets cast in "golden bronze." These tablets are finely sculptured, and after casting they were hand-finished to equal the finest jewelry. The artist of the design was T. O. Matthews, Avalon, Pa., and W. K. Hall, Rome, N. Y.

The Waterbury Machine Company, of Waterbury, Conn., manufacturers of wire-drawing and wire mill machinery, eyelet machinery and special metal working machinery, are putting up an addition to their factory. Crowded conditions and growing business are responsible for the enlargement. The new building will be added on to the present four-story building and will be eighty feet in length. A new engine and the necessary machine tools have already been contracted for.

M. E. Keeley who now owns the Connecticut Brass Company, at Mixville, Conn., reports that the company will have a thoroughly modern plant with all new machinery including boilers, engines, etc., and he will double the capacity of the works. The investment will be over $100,000. The company is a roller of sheet brass. No stock company has been organized as yet, the property being owned entirely by M. E. Keeley who is well known in Waterbury as a buyer and seller of metals.

The American Bronze Company, recently incorporated at Buffalo, N. Y., with a capital of $25,000, has taken over the business of the Work Casting Company, located at 1415 Niagara street. E. G. Northrop is general manager of the concern and states that they have enlarged their foundry, by erecting a new building having a capacity for 25 extra molders, which they are now working to full limit, and consequently are in a position to accept large contracts. The American Bronze Company make

a specialty of "A. B. C." manganese bronze ingots, and will also manufacture red, prosphor and manganese brass castings.

The Providence Metal Spinning Company, of Providence, R. I., of which William H. Culf is proprietor, report that they are very busy on orders for spinning and for stamped metal novelties. This is one of the largest spinning concerns in the East and they make a specialty of oval spinning in gold, silver and all other kinds of metals. They also refinish silverware and do burnishing for manufacturing jewelers. Mr. Culf has been established in business at Providence for many years, and his son, who is associated with him, represents the fifth generation in a family of metal spinners and workers. The business at Providence has been built up to the point where it includes customers from all parts of the country.

The Eureka Pneumatic Spray Company, New York, announce that on account of the rapid growth of their business they have been compelled to move to larger quarters at 276 Spring street, near Varick street, where they have secured an entire building which they will use as warerooms and for demonstrating purposes. An elaborate exhibition room will be fitted up, the floor, walls and ceiling of which will be finished with material applied by Eureka sprayers, while the contents of the room, including all metal fittings, desks, chairs, pottery, picture frames, etc. will likewise illustrate the efficiency of Eureka sprayers in applying all kinds of liquid finishes to any kind of material. The warerooms will show the company's complete line of lacquer sprayers, air compressors, exhausters, blowers, etc., and a model lacquer spraying plant will be shown in operation. The company has recently put on the market a new size of their Record sprayers, half pint capacity, which retails at $8.00.

CANADIAN ROLLING MILL STARTS.

The Ontario Brass Rolling Mills, Limited, New Toronto, Ontario, Canada, have made an official announcement that they have acquired the plant formerly operated by the Canada Brass Rolling Mills at New Toronto and will now carry on the manufacture of brass, copper, bronze and German silver in sheet, plate and rod. It is stated that the corporation is strictly Canadian, that the mill has been organized to supply the Canadian trade and it asks the support of Canadian consumers. The present officers of the company are: J. F. Brown, president; E. P. McMahon, general manager; J. J. Walsh, treasurer, and F. R. Farrel, secretary. Mr. Brown and Mr. Walsh have been for many years residents of Toronto and Mr. McMahon and Mr. Farrel were formerly connected with the Detroit Copper and Brass Rolling Mills and the Michigan Copper and Brass Company, of Detroit, Mich. Besides these members of the staff, they also include Ferdinand Deming, who as mentioned on our "Personal Page" of this issue is the Ontario Mills' Master Mechanic.

REMOVALS

The Gilmer Company, Philadelphia, Pa., manufacturers of endless polishing belts has moved to 52 North 7th street, Philadelphia.

The Chicago (Ill.) office of the Hanson & Van Winkle Company, manufacturers of platers' supplies, has been changed to 109 North Canal street.

The removal of the Slade Tubing Company from Pawtucket, R. I., to Rome, N. Y., mentioned in our August number was completed during the past month, and the company report that they have added much new equipment and now have an up-to-date plant for the production of small-sized brass and copper seamless tubing and are in a position to handle orders of any kind both as to quality and quantity with the greatest possible dispatch.

INCORPORATIONS

WILLIAMS SEALING CORPORATION. To manuacture bottle caps, Waterbury, Conn. Capital stock, $100,000, all paid in. President, J. H. Goss; treasurer, George A. Williams; secretary, Nathaniel R. Bronson; directors, J. H. Goss, G. A. Williams, N. R. Bronson, W. W. Manville and C. D. Nye, all of Waterbury.

THE COE-STAPELY COMPANY, Bridgeport, Conn. To manufacture metal and allied goods. Capital, $50,000. Directors: Benjamin L. Coe, president; William S. Stapely, vice-president and general manager; Ellery B. Shoemaker, secretary, and Benjamin S. Coe, treasurer.

PRINTED MATTER

THE 1910 WATERBURY-FARREL GENERAL CATALOGUE. A new catalogue of the Waterbury Farrel Foundry and Machine Company, of Waterbury, Conn., is a 205-page book fully illustrated with half-tone cuts and bound in gray cloth. The book is most conveniently arranged, each chapter being devoted to a special class of machinery, grouped under an alphabetical index. Full descriptions of each class is given in a clear and concise manner.

The classification runs from A to U inclusive and is also represented by an illustrated catalogue which gives detailed specifications and descriptions of the individual machines. A list of these catalogues, the titles of which are also the headings of the chapters of the book, is given below.

A—Automatic cold process nut, bolt and rivet machinery. Thread rolling machines.

B—Machinery for manufacturing hinges and butts from sheet steel and brass.

C—Cartridge machinery for making metallic cases, bullets, paper shot shells, primers.

D—Drop presses. Automatic boardlift drop hammers for forging and stamping.

F—Foot presses and screw presses. Button covering foot presses.

G—Chain draw benches for tubing and rods. Bull blocks. Tube pointers and saws.

H—Hydraulic draw benches. Presses, accumulators. Power pumps. Valves.

K—Knuckle joint embossing presses. Horizontal and special presses.

L—Lathes for burnishing, knurling, trimming and spinning sheet metal.

M—Single acting open back power presses. Automatic feeds and attachments.

N—Single acting blanking and drawing presses (pillar pattern) with feeds.

O—Double acting power presses. Crank, cam, and toggle action presses.

R—Rolling mills for rolling sheet brass, copper, steel, tin foil, etc. Rod rolls.

S—Shear presses and alligator shears. Single and gang slitters and rotary trimmers.

T—Finishing machinery for sheet brass, German silver, etc. Roll straighteners.

U—Muffles, casting shops and furnaces.

Either the general or any of the special catalogues will be sent upon request.

AD NEWS

Hermann Gehnrich, 518 Water street, New York, is advertising his patented sectional portable ovens for japanning, lacquering, enameling, drying, tempering, sherardizing, etc.

M. M. Andler & Company, Boston, Mass., dealers in metals and consumers of skimmings, grindings, drosses, brass foundry ashes, etc., are now advertising their business in THE METAL INDUSTRY.

Osborn Economy Wheels, made with crimped and tangled wires which will not become crystallized and brittle from vibration, are the subject of the Osborn Manufacturing Company's advertisement this month.

The W. W. Oliver Manufacturing Company, Detroit, Mich., ask drop press users to send for catalogue No. 17, which describes the special features of the Oliver Quality Drop Press, which they claim is a particularly well-designed and efficient machine.

The Northern Manufacturing & Refinishing Works, Cleveland,

Ohio, announce that they are prepared to handle large or small orders for gold, silver, nickel, bronze or brass plating and for repairing all kinds of metal goods. They make a specialty of finishing safety razors.

The Curtis Centrifugal Dryer Company, Worcester, Mass., are advertising their apparatus for drying out metal goods after plating, dipping, pickling, etc., without the use of sawdust. It is made in two sizes, one for manufacturing jewelers' use and the other for larger work.

C. L. Constant Company, 42 Broadway, New York, which is the reorganization of the consulting business of C. L. Constant, official chemist of the New York Metal Exchange, announce that they have unexcelled facilities for assaying and analyzing ores, metals, drosses, or furnace products. This firm analyzes and assays anything that contains metals, advises on metallurgical processes and looks out for the interests of their clients at the refineries.

COPPER PRODUCTION

(Issued by the Copper Producers' Association.)

November 10, 1909.

	Pounds.	
Stocks of marketable copper of all kinds on hand at all points in the United States, October 1, 1909....	151,472,772	
Production of marketable copper in the United States from all domestic and foreign sources during October, 1909	124,657,709	
		276,130,481
Deliveries:		
For domestic consumption	66,359,617	
For export	50,261,238	
		122,620,855
Stock of marketable copper of all kinds on hand at all points in the United States, November 1, 1909.		153,509,626
Stocks increased during the month of October.....		2,036,854

METAL MARKET REVIEW

NEW YORK, November 5, 1909.

COPPER.—The London market was very dull and weak during the early part of the month, and lower prices were reached than for some months past. During the last ten days of October the market firmed up and prices were advanced about £2 per ton from the lowest. At the close the price for spot Standard shows a net decline for the month of about £2 per ton, closing at £57 12s. 6d. The trading has been quite heavy.

The tendency today is, and has been for months, to run the copper market, through tips given out in Wall Street. We were told one day that 75,000,000 pounds of copper had been sold to consumers, another time we were told that a gigantic combination had been formed, or was forming, to control the copper trade, the last was that producers or selling agents had agreed to work together in harmony for the betterment of the trade and to put a stop to all sudden and violent fluctuations in the copper market.

But the writer believes that these reports are all more or less fictitious and misleading, but for the time being they had their effect on Amalgamated stock, and that covers the whole point.

There is enough copper being produced today at a cost of 8c. to 9c. per pound to supply the home market and plenty to spare and, with copper selling at 13c. per pound, any suggestion to curtail production is very naturally promptly turned down.

Statistically, the market is in very bad shape, from the producer's point of view, and in very good shape from the consumer's point of view. With stocks of copper steadily increasing consumers are more than willing to let producers carry the load and for this reason they will only buy as their needs demand.

The visible supply of copper as published by the Producers' Association on the 11th of October showed an increase of over 15,000,000 pounds. The foreign stocks of copper showed an increase of 6,000 tons, or over 13,000,000 pounds during the month of October. In these foreign statistics it is to be noted that Australia is shipping more copper; the shipment in October increased about 3,000 tons over the September shipments.

The exports for the month were 23,651 tons, against 21,962 tons for the same period last year.

There has been a better demand from consumers and the market generally is firmer than a few weeks back. Lake, 13¼ cents; Electrolytic, 13 cents; Casting, 12⅞ cents.

On the Metal Exchange Standard Copper has been very dull, with sellers for any delivery this year at 12.20 to 12.25. At the close the market is firmer, at 12½ bid, 12¾ to 13 cents asked.

TIN.—In London the price of tin shows a net decline for the month of about £1 per ton. Trading has been quite active.

In the New York market the deliveries have been exceptionally heavy, 4,000 tons, the total consumption for the 10 months, showing an increase of 7,050 tons, compared with the same period last year.

The shipments from the Straits were small, being only 3,630 tons, against total deliveries of 6,635, the total visible supply at the end of October showing a decrease of over 3,000 tons during the month, and on this basis the statistics are favorable for higher prices. The market closes at 30½ cents for spot, to 30.60 for futures, 5-10-ton lots.

LEAD.—The foreign lead market holds steady at around £13.

In the New York market lead has ruled dull and more or less easy at 4.35 New York. In East St. Louis prices have been dull, at around 4¼ cents.

SPELTER.—The market for spelter has been quite active and prices have been advanced from 5.85 New York to 6.45. This advance was not in any way legitimate, but the market has been cornered by a certain interest and consumers will have to pay the price for the time being. Prices can hardly go any higher, as spelter can be imported today at 6½ cents. In East St. Louis prices ranged from 5.75 to 6.25 at the close.

ALUMINUM.—The market is steady, at 22½ to 23 cents for large lots, and 23½ to 24 cents for small lots.

ANTIMONY.—The London price is £29 for Halletts, and £28 10s. for other brands.

In the New York market Cooksons, 8⅛; Halletts, 8⅛; with Hungarian grade at around 7½ cents.

SILVER.—In the London market silver has declined about ¾d. during the month, closing at 23 1/16d.

In New York prices are lower, closing at 50c.

QUICKSILVER.—The market is rather firmer, £8 17s. 6d. in London, and wholesale prices in New York $46; small lots $47.50 to $48 per flask.

PLATINUM.—The market is strong and prices continue to advance. Hard, $32.25 and ordinary, at $28.50.

SHEET METALS.—There has been no change in the base price of sheet metals. Copper, 17 cents base, wire at 15 cents. Sheet brass, 14 cents, with rods and wire at 14¼ cents.

OLD METALS.—The market has been dull and unsettled, closing slightly firmer in sympathy with the firmer copper market.

F. F. A.

THE OCTOBER MOVEMENTS IN METALS

COPPER.	Highest.	Lowest.	Average.
Lake	13.25	13.00	13.10
Casting	13.00	12.75	12.90
Electrolytic	13.00	12.75	12.95
TIN	30.65	29.75	30.40
LEAD	4.45	4.35	4.40
SPELTER	6.45	5.75	6.15
ANTIMONY (Hallett's)	8.35	8.12½	8.15
SILVER	.51½	.50	50.75

WATERBURY AVERAGE

The average price of lake copper per pound as determined monthly at Waterbury, Conn.

1909. Jan. 14⅜ Feb. 13¼ Mar. 12⅞ April 13 May 13¼ June 13½ July 13½ August 13½ Sept. 13¾ Oct. 13⅛.

Trade Wants on Advertising Pages 36 to 38 Following

Metal Prices, November 5, 1909.

NEW METALS.

	Price per lb. Cents.
COPPER—PIG, BAR AND INGOT AND OLD COPPER. Duty Free, Manufactured 2½c. per lb.	
Lake, car load lots	13.25
Electrolytic, car load lots	13.00
Casting, car load lots	13.00
TIN—Duty Free.	
Straits of Malacca, car load lots	30.50
LEAD—Duty Pigs, Bars and Old, 2½c. per lb.; pipe and sheets, 2¾c. per lb.	
Pig lead, car load lots	4.35
SPELTER—Duty 1¾c. per lb. Sheets, 1⅝c. per lb.	
Western car load lots	6.45
ALUMINUM—Duty Crude, 7c. per lb. Plates, sheets, bars and rods, 11c. per lb.	
Small lots	28.00
100 lb. lots	25.00
Ton lots	24.00
ANTIMONY—Duty 1½c. per lb.	
Cookson's, cask lots, nominal	8.35
Hallett's, cask lots	8.10
Other cask lots	7.50
NICKEL—Duty Ingot, 6c. per lb. Sheet, strips and wire 35% ad valorem.	
Shot, Plaquettes, Ingots, Blocks, according to quantity	.45 to .60
MANGANESE METAL—Duty 20%	.80
MAGNESIUM METAL—Duty 3 cents per pound and 25% ad valorem	$1.75
BISMUTH—Duty free	1.80
CADMIUM—Duty free	.75
	Price per oz.
GOLD—Duty free	$20.67
SILVER—Duty free	.50
PLATINUM—Duty free	29.25
QUICKSILVER—Duty 7c. per lb. Price per pound	70c. to 72c.

OLD METALS.

Dealers' Buying prices. Cents per lb.		Dealers' Selling prices. Cents per lb.
11.75 to 12.00	Heavy Cut Copper	12.75 to 13.00
11.50 to 11.75	Copper Wire	12.25 to 12.50
10.00 to 10.50	Light Copper	11.00 to 11.25
10.75 to 11.75	Heavy Mach. Comp.	11.75 to 12.00
8.00 to 8.50	Heavy Brass	9.00 to 9.25
6.00 to 6.50	Light Brass	7.00 to 7.25
7.50 to 8.00	No. 1 Yellow Brass Turnings	8.25 to 8.50
8.50 to 9.00	No. 1 Comp. Turnings	9.50 to 10.00
3.90 to 4.00	Heavy Lead	4.20 to 4.25
4.40 to 4.50	Zinc Scrap	5.00 to 5.25
5.00 to 6.00	Scrap Aluminum, turnings	5.00 to 6.75
10.00 to 12.00	Scrap Aluminum, cast, alloyed	11.00 to 13.00
14.00 to 15.00	Scrap Aluminum, sheet (new)	16.00 to 18.00
18.00 to 19.00	No. 1 Pewter	—— to ——
20.00 to 25.00	Old Nickel	20.00 to 25.00

INGOT METALS.

	Price per lb. Cents.
Silicon Copper, 10% to 20%....according to quantity	28 to 35
Silicon Copper, 30%, guaranteed " "	38
Phosphor Copper, 5% " "	19 to 21
Phosphor Copper, 10% to 15%, guaranteed " "	28 to 30
Manganese Copper, 30% " "	30 to 35
Phosphor Tin " "	34 to 36
Brass Ingot, Yellow " "	9 to 10
Brass Ingot, Red " "	12 to 13
Bronze Ingot " "	11 to 12
Manganese Bronze " "	17 to 19
Phosphor Bronze " "	13 to 16
Casting Aluminum Alloys " "	29 to 35
PHOSPHORUS—Duty 18c. per lb. According to quantity	30 to 35

PRICES OF SHEET COPPER.

BASE PRICE, 17 Cents per Lb. Net.

PRICES MENTIONED BELOW ARE FOR QUANTITIES OF 100 LBS. AND OVER.

SIZE OF SHEETS.		64 oz. and over 60 lb. sheet 30 x 60 and heavier.	32 oz. to 64 oz. 25 to 50 lbs. sheet 30 x 60.	24 oz. to 32 oz. 18¾ to 25 lb. sheet 30 x 60.	16 oz. to 24 oz. 12½ to 18¾ lb. sheet 30 x 60.	14 oz. and 15 oz. 11 to 12½ lb. sheet 30 x 60.	12 oz. and 13 oz. 9½ to 11 lb. sheet 30 x 60.	10 oz. and 11 oz. 7⅝ to 9⅛ lb. sheet 30 x 60.	8 oz. and 9 oz. 6¼ to 7⅜ lb. sheet 30 x 60.	Lighter than 8 oz.
		Cents Per Pound Over Base Price for Soft Copper.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	1	2	3	6	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	3	6	9	
	Longer than 96 inches.	"	"	"	"	2	6			
Wider than 30 ins. but not wider than 36 inches.	Not longer than 72 inches	"	"	"	"	2	4	7	10	
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	2	6	9		
	Longer than 96 inches. Not longer than 120 inches.	"	"	"	1	3				
	Longer than 120 inches.	"	"	1	2					
Wider than 36 ins. but not wider than 48 inches.	Not longer than 72 inches.	"	"	1	2	4	7	10		
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	5	8			
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	8				
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins. but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	6	11			
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	9				
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Longer than 120 inches.	3	5	9						
Wider than 108 Ins.	Not longer than 132 inches.	4	6							
	Longer than 132 inches.	5	8							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, SEGMENTS AND PATTERN SHEETS, advance over prices of Sheet Copper required to cut them from. 3 cents per pound.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot, and heavier, add 1 " " "

COLD OR HARD ROLLED COPPER, lighter than 14 oz., per square foot, add 2 " " "

POLISHED COPPER, 20 INCHES WIDE and under, advance over price for Cold Rolled Copper of corresponding dimensions and thickness 1 " " sq. ft.

POLISHED COPPER, WIDER THAN 20 INCHES, advance over price for Cold Rolled Copper of corresponding dimensions and thickness 2 " " " "

COLD ROLLED COPPER, PREPARED SUITABLE FOR POLISHING, same as Polished Copper of corresponding dimensions and thickness.

COLD ROLLED AND ANNEALED COPPER SHEETS OR CIRCLES, same price as Cold or Hard Rolled Copper of corresponding dimensions and thickness.

ROUND COPPER ROD, ¾ inch diameter or over.....Base Price.

(Rectangular, Square and Irregular Shapes, Copper Rod, Special Prices.)

ZINC—Duty, sheet, 1½c. per lb.	Cents per lb.
Carload lots, standard sizes, at mill	8.00 less 8%
Casks	8.50
Open casks	9.00

Metal Prices, November 5, 1909

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect September 15, 1909, and until further notice.

To customers who purchase less than 40,000 lbs. per year and over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.13½	$0.15	$0.17
Wire	.13½	.15¾	.17¼
Rod	.13½	.15¾	.18¼
Brazed tubing	.19⅜	—	.21½
Open seam tubing	.17⅜	—	.19½
Angles and channels, plain	.17⅜	—	.19½

50% discount from all extras as shown in American Brass Manufacturers' Price List No. 7.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass...	⅛c.	per lb. net advance
" —Best spring, drawing and spinning brass....	1⅛c.	" " "
Wire—Extra spring and brazing wire	⅛c.	" " "
" —Best spring and brazing wire	1c.	" " "

To customers who purchase less than 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.14½	$0.16	$0.18
Wire	.14½	.16¾	.18¼
Rod	.14½	.16¾	.19¼
Brazed tubing	.20⅜	—	.22½
Open seam tubing	.18⅜	—	.20½
Angles and channels, plain	.18⅜	—	.20½

5% discount from all extras as shown in American Brass Manufacturers' Price List No. 7.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass...	⅛c.	per lb. net advance.
" —Best spring, drawing and spinning brass....	1⅛c.	" " "
Wire—Extra spring and brazing wire	⅛c.	" " "
" —Best spring and brazing wire	1c.	" " "

BARE COPPER WIRE—CARLOAD LOTS.

14½c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	18½c. per lb. base.
100 lbs. to 300 lbs. in one order	19c. " " "
Less than 100 lbs. in one order	20½c. " " "

PRICES FOR SEAMLESS BRASS TUBING.

From 1¼ to 3½ in O. D. Nos. 4 to 13 Stubs' Gauge, 18c. per lb.
Seamless Copper Tubing, 22c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron Pipe Size	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
Price per lb.	26	25	20	19	18	18	18	18	18	18	18	19	20	22	24	25

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch	$8	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1⅛ inch	22	24
1¼ inch	25	27
1⅜ inch	32	35
1⅝ inch	45	48
2 inch	56	60

Discount 45 and 5%.

PRICES FOR MUNTZ METAL AND TOBIN BRONZE.

Muntz or Yellow Metal Sheathing (14" x 48")	14c.	lb. net base
" " " Rectangular sheets other than Sheathing	16c.	" " "
" " " Rod	15c.	" " "
Tobin Bronze Rod	16c.	" " "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bars in the rough 22½c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturers.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Not over 18 in. in width, not thinner than 23 B. S. Gauge, 4c. above price of pig tin in same quantity.

Not over 35 in. in width, not thinner than 23 B. S. Gauge, 5c. above price of pig tin.

PRICE LIST FOR SHEET ALUMINUM—B. & S. Gauge.

	Wider than.....	3in.	6in.	14in.	16in.	18in.	20in.	24in.	30in.	36in.
	and including.....	12in.	14in.	16in.	18in.	20in.	24in.	30in.	36in.	40in.
	in coils.									
No. 13 and heavier		33	33	35	35	35	35	38	38	38
" 14		33	33	35	35	35	35	38	38	38
" 15		33	33	35	35	35	35	38	38	38
" 16		33	33	35	35	35	35	38	38	38
" 17		33	33	35	35	35	35	38	38	38
" 18		33	33	35	35	35	35	38	38	41
" 19		33	33	35	35	35	35	38	39	42
" 20		33	35	35	35	35	37	40	41	43
" 21		33	37	37	37	37	39	42	43	49
" 22		33	37	37	37	39	39	42	46	50
" 23		33	37	37	37	39	39	42	48	51
" 24		33	37	39	41	41	41	44	50	53
" 25		35	38	40	42	42	42	45	52	56
" 26		35	38	41	45	45	45	50	54	60
" 27		35	39	43	47	47	48	53	57	63
" 28		35	39	45	47	48	48	55	61	66
" 29		37	40	47	49	51	51	60	66	71
" 30		37	41	49	51	55	61	68	71	76
" 31		42	46	54	57	62	70	73	76	82
" 32		44	48	56	60	68	76	90	89	94
" 33		46	50	59	64	72	83	90	99	109
" 34		49	54	61	69	77	90	102	109	119
" 35		..	64	69	79	89	99	114	124	..
" 36		..	79	89	99	114	119	134	..	..
" 37		..	103	113	128	143	158	173	..	..
" 38		..	123	138	153	168	183	203	..	..
" 39		..	143	163	183	203	223	..	..	..
" 40		..	173	203	223	243	..	..	..	..

In flat rolled sheets the above prices refer to lengths between 2 and 3 feet. Prices furnished by the manufacturers for wider and narrower sheet. All columns except the first refer to flat rolled sheet. Prices are 100 lbs. or more at one time. Less quantities 5c. lb. extra. Charges made for boxing.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.
Outside Diameters. BASE PRICE, 25 Cents per Pound.

Stubs' Gauge.	Inches.	⅛ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 ins.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.	..	..	..	..	..	..	..	26	23	..	..	13	11	9	8	15	22
12.	.109.	..	..	..	..	..	..	..	25	..	..	..	14	..	..	..	..	..
14.	.083.	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..
16.	.065.	..	..	..	..	..	27	26	26	23	22	20	20	20	20	26	30	56
18.	.049.	..	..	..	..	32	29	28	27	24	25	25	25	..	..	..	..	..
20.	.035.116	..	45	38	33	32	31	29	28	29	29	29	30	37	48	57	80	
21.	.032.	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..
22.	.028.137	97	47	41	37	36	34	33	..	..	44	..	..	..	..	..	..	..
24.	.022.187	132	107	87	78	72	61	59	65	..	..	..	..	..	..	..	..	..

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

Diameter. B. & S. G'ge.	000 to No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price, per lb....	31	31½	31½	32	32½	33	33½	34	35	36	37	42	45

200 lbs. to 30,000 lbs., 3 cents off list; 30,000 lbs. and over, 4 cents off list.

PRICE LIST FOR GERMAN SILVER IN SHEETS AND ROLLS.

Per cent.	Price per lb.	Per cent.	Price per lb.
12	$0.52	16	$0.58
13	.53	17	.59
14	.54	18	.60
15	.55		

These prices are for sheets and rolls over 2 inches in width, to and including 8 inches in width and to No. 20, inclusive, American or Brown & Sharpe's Gauge. Prices are for 100 lbs. or more of one size and gauge in one order. Discount 50%.

GERMAN SILVER TUBING.

4	per cent.	to	No.	19,	B. & S.	Gauge,	inclusive	$0.60
6	"	"		19,	"	"	"	.70
9	"	"		19,	"	"	"	.85
12	"	"		19,	"	"	"	1.00
15	"	"		19	"	"	"	1.15
16	"	"		19,	"	"	"	1.20
18	"	"		19,	"	"	"	1.30

German Silver Tubing thinner than No. 19 B. & S. Gauge add same advances as for Brazed Brass Tube.

For cutting to special lengths add same advances as for Brazed Brass Tube. Discount 40%.

PRICE OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quality and market conditions. No fixed quotations can be given as prices range from 3c. below to 6c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2c. to 3c. above the price of bullion.

President, F. N. PERKINS,
The Arcade Mfg. Co., Freeport, Ill.

Treasurer, J. S. McCORMICK,
J. S. McCormick Co., Pittsburg, Pa.

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WM. LODGE, The Lodge & Shipley Machine Tool Co., Cincinnati, O.

The Foundry and Manufacturers' Supply Association

ORGANIZED TO CO-OPERATE WITH ALL FOUNDRY AND MANUFACTURING INTERESTS IN MAKING AN ANNUAL EXHIBIT OF SUPPLIES AND EQUIPMENT

TRUSTEES.

E. H. MUMFORD,
E. H. Mumford Co., Philadelphia, Pa.

U. E. KANAVEL,
The Inter-State Sand Co., Cleveland, Ohio.

T. S. HAMMOND,
Whiting Foundry Equipment Co., Harvey, Ill.

E. J. WOODISON,
The Detroit Foundry Supply Co., Detroit, Mich.

TRUSTEES.

GEO. R. RAYNER,
The Carborundum Co., Niagara Falls, N. Y.

J. S. SMITH,
The J. D. Smith Foundry Supply Co., Cleveland, Ohio.

GEO. H. WADSWORTH,
Falls Rivet & Machine Co., Cuyahoga Falls, O.

E. A. PRIDMORE,
of Henry E. Pridmore, Chicago, Ill.

H. R. ATWATER,
The Osborn Mfg. Co., Cleveland, Ohio.

The next Convention will be held in Detroit, Mich.

¶ Every firm or man selling supplies or equipment for foundries, pattern shops and machine shops should certainly be a member. ¶ Full information can be obtained from C. E. HOYT, Secretary, Care of Lewis Institute, Chicago, Ill.

LIST OF MEMBERS

1	American Smelting & Refining Co.	Cincinnati, Ohio.	50	Koppel, Arthur, Co.	Pittsburg, Pa.
2	Arcade Mfg. Co.	Freeport, Ill.	51	Kroeschell Bros. Co.	Chicago, Ill.
3	Barnett, Oscar, Foundry Co.	Newark, N. J.	52	Lane & Bodley Mfg. Co.	Cincinnati, Ohio.
4	Baird & West	Detroit, Mich.	53	Lodge & Shipley Mach. Tool Co.	Cincinnati, Ohio.
5	Bartley, Jonathan, Crucible Co.	Trenton, N. J.	54	Lindsay, W. W., Co.	Philadelphia, Pa.
6	Berkshire Mfg. Co., The	Cleveland, Ohio	55	McCormick, J. S., Co.	Pittsburg, Pa.
7	Birkenstein & Sons, S.	Chicago, Ill.	56	Macleod, Walter, & Co.	Cincinnati, Ohio.
8	Brown Specialty-Machinery Co.	Chicago, Ill.	57	Manufacturers Equipment Co.	Chicago, Ill.
9	Browning Engineering Co.	Cleveland, Ohio.	58	Metal Dross Economy Co.	Bristol, Conn.
10	Buch's Sons Co., A.	Elizabethtown, Pa.	59	Metal Industry.	New York, N. Y.
11	Burroughs Adding Machine Co.	Detroit, Mich.	60	Millers Products Co.	Chicago, Ill.
	Byram & Co.	Detroit, Mich.	61	Mills, H. E., Mfg. Co.	Syracuse, N. Y.
12	Calumet Engineering Works	Harvey, Ill.	62	Monarch Engineering & Mfg. Co.	Baltimore, Md.
13	Canadian Machinery	Toronto, Ont., Canada.	63	Mumford, E. H., Co.	Philadelphia, Pa.
14	Carborundum Co., The	Niagara Falls, N. Y.	64	National Core Oil Co.	Corning, N. Y.
15	Central Foundry Supply Co.	Columbus, Ohio.	65	Newport Sand Bank Co.	Newport, Ky.
16	Chicago Pneumatic Tool Co.	Chicago, Ill.	66	Northern Engineering Works	Detroit, Mich.
17	Cleveland Wire Spring Co., The	Cleveland, Ohio.	67	Obermayer Co., S.	Cincinnati, Ohio.
18	Crivel, Geo. F., Co.	Buffalo, N. Y.	68	Oliver Machinery Co.	Detroit, Mich.
19	Curtis & Co. Mfg. Co.	St. Louis, Mo.	69	Osborn Mfg. Co.	Cleveland, Ohio.
20	Cutter, Wood & Stevens Co.	Boston, Mass.	70	Pangborn, Thomas W., Co.	New York, N. Y.
21	Demmler, Wm., & Bros.	Kewaunee, Ill.	71	Parker Bros. Co., Ltd.	Detroit, Mich.
22	Detroit Foundry Supply Co.	Detroit, Mich.	72	Paxson, J. W., Co.	Philadelphia, Pa.
23	Detroit Testing Laboratories, The	Detroit, Mich.	73	Penton Publishing Co.	Cleveland, Ohio.
24	Diamond Clamp & Flask Co.	Richmond, Ind.	74	Peterson, T. J., Co.	Chicago, Ill.
25	Dings Electro-Magnetic Separator Co.	Milwaukee, Wis.	75	Pettinos Bros.	Bethlehem, Pa.
26	Dixon, Jos., Crucible Co.	Jersey City, N. J.	76	Philadelphia Chaplet & Mfg. Co.	Philadelphia, Pa.
27	Doggett, Stanley	New York, N. Y.	77	Pickands, Brown & Co.	Chicago, Ill.
28	Drucklieb, C.	New York, N. Y.	78	Pilling & Crane	Philadelphia, Pa.
29	Falls Rivet & Machine Co.	Cuyahoga Falls, Ohio.	79	Piqua Flour Co.	Piqua, Ohio.
30	Fay & Egan Co., J. A.	Cincinnati, Ohio.	80	Pridmore, H. E.	Chicago, Ill.
31	Federal Foundry Supply Co.	Cleveland, Ohio.	81	Robeson Process Co.	Au Sable Forks, N. Y.
32	Foundry Specialty Co.	Cincinnati, Ohio.	82	Rockwell Furnace Co.	New York, N. Y.
33	Garden City Sand Co.	Chicago, Ill.	83	Rogers, Brown & Co.	Cincinnati, Ohio.
34	Gardner Printing Co.	Cleveland, Ohio.	84	Ross Tacony Crucible Co.	Tacony, Philadelphia, Pa.
35	General Electric Co.	Schenectady, N. Y.	85	Sand Mixing Machine Co.	New York, N. Y.
36	Goldschmidt Thermit Co.	New York, N. Y.	86	Sellers, Wm., & Co., Inc.	Philadelphia, Pa.
37	Gregg Mfg. Co.	Cleveland, Ohio.	87	Sly, W. W., Mfg. Co.	Cleveland, Ohio.
38	Gulick-Henderson Co.	Pittsburg, Pa.	88	Smith, J. D., Foundry Supply Co.	Cleveland, Ohio.
39	Hanna Engineering Works.	Chicago, Ill.	89	Squier, Ed. E., Co.	St. Louis, Mo.
40	Hauck Mfg. Co.	Brooklyn, N. Y.	90	Standard Sand & Machine Co.	Cleveland, Ohio.
41	Hawley Down Draft Furnace Co.	Chicago, Ill.	91	Sterling Wheelbarrow Co.	Milwaukee, Wis.
42	Herman Pneumatic Machine Co.	Pittsburg, Pa.	92	Stevens, Frederic B.	Detroit, Mich.
43	Hickman-Williams Co.	Cincinnati, Ohio.	93	Sturtevant, B. F., Co.	Hyde Park, Mass.
44	Hill & Griffith Co.	Cincinnati, Ohio.	94	Tabor Mfg. Co.	Philadelphia, Pa.
45	Holland Linseed Oil Co.	Chicago, Ill.	95	United States Graphite Co.	Saginaw, Mich.
46	Interstate Sand Co.	Cleveland, Ohio.	96	Whitehead Bros. Co.	New York, N. Y.
47	Kawin, C. C., Co.	Chicago, Ill.	97	Whiting Foundry Equipment Co.	Harvey, Ill.
48	Kelley, T. P., & Co.	New York, N. Y.	98	Wise, J. B.	Watertown, N. Y.
49	Killing Molding Mach. Wks., E.	Davenport, Iowa.	99	Wonham, Magor & Sanger	New York, N. Y.

SEE PAGE 36 FOR WANT ADVERTISEMENTS

DIRECTORY

METAL ROLLING MILLS.

INGOT, SHEET, ROD, WIRE, TUBE, METAL GOODS.

HENDRICKS BROTHERS
Manufacturers of
Sheet and Bar Copper
COPPER FIREBOX PLATES
and STAYBOLTS
WIRE and BRAZIER'S RIVETS
IMPORTERS AND DEALERS IN
INGOT COPPER, BLOCK TIN,
SPELTER, LEAD, ANTIMONY
BISMUTH, NICKEL, Etc.
49 Cliff Street, NEW YORK

Established 1802 Cable Address: "Scovill"
SCOVILL MFG. CO.
WATERBURY, CONN.
THE LARGEST AND MOST FULLY EQUIPPED BRASS ROLLING MILLS AND METAL GOODS MANUFACTURING ESTABLISHMENT IN THE WORLD
Estimates for Specialties in Brass, German Silver and Aluminum furnished on application. DEPOTS:
NEW YORK: 75 Spring St. BOSTON: 170 Summer St. CHICAGO: 210 Lake St.

WATERBURY BRASS CO.
General Offices, Mills and Factories.
Waterbury, Conn.
NEW YORK OFFICE, 99 JOHN STREET.
Providence (R. I.) Store, 131 Dorrance St.
Shipments Upon Receipt of Order
From Large Stock of
SEAMLESS DRAWN BRASS AND COPPER TUBING
BRASS { SHEET ROD WIRE
COPPER { SHEET ROD WIRE
GERMAN SILVER { SHEET ROD WIRE
AT WATERBURY

Non-Corrosive Finest Quality
COPPER AND YELLOW
(Muntz) Metal
Naval Brass
Naval Bronze
Manganese Bronze
Plates, Sheets, Bolts, Bars, Rods, Nails, Tacks, &c.
Taunton-New Bedford Copper Co.
NEW BEDFORD, MASS.
71 Water St., New York 61 Batterymarch St., Boston

C. G. HUSSEY & CO.
PITTSBURGH, PENNA.
Manufacturers of
COPPER
In Sheets, Plates, Rolls
ANODES
Tacks and Nails

Bridgeport Brass Co.
BRIDGEPORT, CONN.
Postal Telegraph Building,
Broadway and Murray St., New York
17 N. 7th Street, Philadelphia
Manufacturers of
Brass and Copper { Sheet Tubing Wire and Rods.
Metal Goods Made to Order from Sheet, Rod, Wire and Tubing

BRASS and COPPER in Sheets and Rolls
SILVER PLATED METAL (for Coach Lamps)
BRITANNIA METAL
B. & M. BABBITT METAL for Bearings
LINING METAL for Automobile Bearings and Copper for Electrical Purposes
H. K. & F. S. BENSON
GLEN RIDGE, N. J

THE SEYMOUR MFG. CO.
SEYMOUR, CONN.
German Silver
BRASS, COPPER and BRONZE IN SHEETS, WIRE, RODS and TUBES
COPPER AND NICKEL ANODES
Resistance Wires, Wire, Shot Copper

UNITED WIRE & SUPPLY COMPANY
109 SUMMER STREET,
PROVIDENCE, R. I.
SEAMLESS BRASS and COPPER TUBING 1" O. D. and smaller in thin gauges. Lightning Rod Points and other tapered tubes.

The Ansonia Brass and Copper Co.
99 John St., New York
MANUFACTURERS OF
BRASS and COPPER Sheets, Tubes, Rods and Wire
SOLE MANUFACTURERS TOBIN BRONZE
(Trade-Mark Registered)

PHENIX TUBE CO.
Manufacturers of
Brass and Bronze Iron Lined Tubes
Brazed Steel Tubes,
Round and Square.
Main Office and Mills: Brooklyn, N. Y. City Branch Offices: Chicago, San Francisco

Baltimore Copper Smelting and Rolling Company
BALTIMORE, MARYLAND
SHEET COPPER

"RIVERSIDE" German Silver Phosphor Bronze
Sheets, Rods, Wire Ingots, Castings, Jewelers' Bars and Alloys
The Riverside Metal Co.
Riverside, Burlington Co., N. J.

THIS SPACE
For Sale
SEND for RATES

SEE PAGE 36 FOR WANT ADVERTISEMENTS

METAL ROLLING MILLS.

INGOT, SHEET, ROD, WIRE, TUBE, METAL GOODS.

HENDRICKS BROTHERS
Manufacturers of
Sheet and Bar Copper
COPPER FIREBOX PLATES
and STAYBOLTS
WIRE and BRAZIER'S RIVETS
IMPORTERS AND DEALERS IN
INGOT COPPER, BLOCK TIN,
SPELTER, LEAD, ANTIMONY
BISMUTH, NICKEL, Etc.
49 Cliff Street, NEW YORK

Established 1802 Cable Address: "Scovill"
SCOVILL MFG. CO.
WATERBURY, CONN.
THE LARGEST AND MOST FULLY EQUIPPED BRASS ROLLING MILLS AND METAL GOODS MANUFACTURING ESTABLISHMENT IN THE WORLD
Estimates for Specialties in Brass, German Silver and Aluminum furnished on application. DEPOTS:
NEW YORK: 75 Spring St. BOSTON: 170 Summer St. CHICAGO: 210 Lake St.

WATERBURY BRASS CO.
General Offices, Mills and Factories.
Waterbury, Conn.
NEW YORK OFFICE, 99 JOHN STREET.
Providence (R. I.) Store, 131 Dorrance St.
Shipments Upon Receipt of Order
From Large Stock of
SEAMLESS DRAWN BRASS AND COPPER TUBING
BRASS { SHEET ROD WIRE
COPPER { SHEET ROD WIRE
GERMAN SILVER { SHEET ROD WIRE
AT WATERBURY

Non-Corrosive **Finest Quality**
COPPER AND YELLOW
(Muntz) Metal
Naval Brass
Naval Bronze
Manganese Bronze
Plates, Sheets, Bolts, Bars, Rods, Nails, Tacks, &c.
Taunton-New Bedford Copper Co.
NEW BEDFORD, MASS.
17 Water St., New York 61 Batterymarch St., Boston

C. G. HUSSEY & CO.
PITTSBURGH, PENNA.
Manufacturers of
COPPER
In Sheets, Plates, Rolls
ANODES
Tacks and Nails

Bridgeport Brass Co.
BRIDGEPORT, CONN.
Postal Telegraph Building,
Broadway and Murray St, New York
17 N. 7th Street, Philadelphia
Manufacturers of
Brass and Copper { Sheet Tubing Wire and Rods.
Metal Goods Made to Order from Sheet, Rod, Wire and Tubing

BRASS and COPPER in Sheets and Rolls
SILVER PLATED METAL (for Coach Lamps)
BRITANNIA METAL
B. & M. BABBITT METAL for Bearings
LINING METAL for Automobile Bearings and Copper for Electrical Purposes
H. K. & F. S. BENSON
GLEN RIDGE, N. J

THE SEYMOUR MFG. CO.
SEYMOUR, CONN.
German Silver
BRASS, COPPER and BRONZE IN SHEETS, WIRE, RODS and TUBES
COPPER AND NICKEL ANODES
Resistance Wires, Wire, Shot Copper

UNITED WIRE & SUPPLY COMPANY
109 SUMMER STREET,
PROVIDENCE, R. I.
SEAMLESS BRASS and COPPER TUBING 1" O. D. and smaller in thin gauges. Lightning Rod Points and other tapered tubes.

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MANUFACTURERS OF
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SOLE MANUFACTURERS **TOBIN BRONZE**
(Trade-Mark Registered)

PHENIX TUBE CO.
Manufacturers of
Brass and Bronze Iron Lined Tubes
Brazed Steel Tubes,
Round and Square.
Main Office and Mills: Brooklyn, N. Y. City Branch Offices: Chicago, San Francisco

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Baltimore Copper Smelting and Rolling Company
BALTIMORE, MARYLAND
SHEET COPPER

METAAOΣ TRADE MARK
"RIVERSIDE" German Silver Phosphor Bronze
Sheets, Rods, Wire, Ingots, Castings
Jewelers' Bars and Alloys
The Riverside Metal Co.
Riverside, Burlington Co., N. J.

THIS SPACE
For Sale
SEND for RATES

SEE PAGE 36 FOR WANT ADVERTISEMENTS

HEADQUARTERS FOR ALL THAT IS NEWEST AND BEST

The "IXL" Lathe
For Grinding and Polishing.

Detachable Spindle, Strong, Efficient, Inexpensive.

Belt runs to shaft overhead or through floor.

IN

EQUIPMENT AND SUPPLIES FOR

Electro-Platers Polishers, Buffers Galvanizers

VICTOR WHITE POLISH
For imparting a fine lustre to nickel-plated work.

Tripoli and Crocus Composition

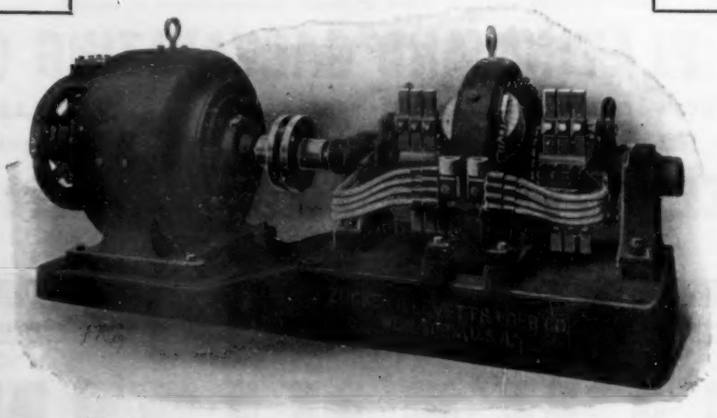
CARBONATE of COPPER and NICKEL SALTS

HAVE you heard of the remarkable records made by our new

Triplex Buff?

How it gives double the wear?
How it saves one fifth the composition?
How it can be remade to original size when worn down?

See cut below.



Direct-Connected Generator Set, Size G. G., Type S. H. Low Voltage Generators, 25 to 12,500 Amperes Capacity. Standard or Three Wire Systems.

THE 1908 ROTOPLATER

Plating and Finishing at one operation in Nickel, Copper, Zinc, Brass or Bronze.

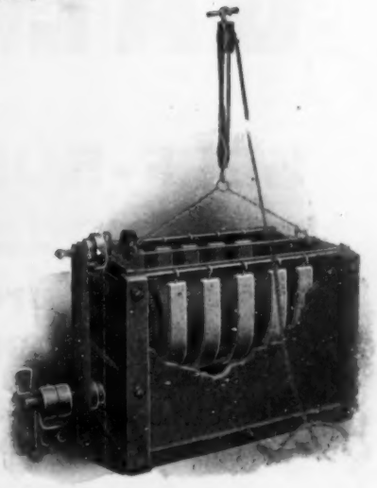
Small sample lots plated free to demonstrate its efficiency.

See cut below.

TWO-BAR SILVERITE NICKEL ANODE

Send for Description.

Also Anodes of all metals made.



ZUCKER & LEVETT & LOEB CO., New York City, U. S. A.

BRANCH OFFICES:
CHICAGO, ILL. BIRMINGHAM, ENG.

Electro-galvanizing Outfits Without Royalty on Solution
Complete Plants Installed and All Supplies for Electro Plating and Polishing

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